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MOROCCO CURRICULUM REVIEW AND CAPACITY BUILDING ACTIVITY (CCA) FINAL REPORT

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Sincerest appreciation for the hard work and dedication of all those involved.

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ACRONYMS

CCA	Morocco Curriculum and Capacity Building Activity
CDCS	Country Development Cooperation Strategy
EDRR	Equity and Diversity Review Rubric
FCR	Findings, Conclusions, Recommendations
FRIE	Frame of Reference of Inclusive Education
FRIECD	Frame of Reference of Inclusive Education for Children with Disabilities
GCR	Global Content Reference Framework for Math
GoM	Government of Morocco
ICT	Information and Communications Technology
LRE	Last Restrictive Environment
MOE	Moroccan Ministry of National Education, Vocational Training, Higher Education and Scientific Research
MSA	Modern Standard Arabic
NPR	National Program for Reading
PIRLS	Progress in International Reading Literacy Study
PNEA	Programme National d'Evaluation des Acquis
RFS	Reading for Success
S&S	Scope and Sequence
SI	Social Impact
SOW	Statement of Work
STEM	Science, Technology, Engineering, and Math
TIMSS	Trends in International Mathematics and Science Study
TLM	Teaching and Learning Material
UDL	Universal Design for Learning
UDLCAR	UDL Curriculum Alignment Rubric
UNICEF	United Nations Children's Education Fund
USAID	United States Agency for International Development

EXECUTIVE SUMMARY

The Morocco Curriculum and Capacity Building Activity (CCA) incorporated remote capacity building training workshops - for 19 selected Moroccan Ministry of National Education, Vocational Training, Higher Education and Scientific Research (MOE) staff and inspectors - who then formally joined the experts on each of three task teams (Task Team 1a, 1b & Task Team 2) to complete a thorough, best practices review of curriculum. The end result was a series of recommendations for aligning middle school curricula, materials and approaches with the newly revised primary school curricula, materials and approaches (Task 1a and 1b) and to strengthen the curriculum's inclusiveness and accessibility for all learners across subjects at the primary level, for grades 1-6 (Task 2). The MOE staff and inspectors who participated in the study are also primed to support the Curriculum Directorate in carrying out related reforms based on their expertise refined through the CCA.

The three key analyses that build the foundational evidence to information future activity design in the area of Basic Education support for Morocco were prioritized:

- Analysis & Capacity Building (Task 1a): Examine primary and middle school reading and Arabic curricula, materials, and structure to identify gaps at the middle school level and highlight areas where alignment across grades is needed.
- Analysis & Capacity Building (Task 1b): Examine primary and middle school science, math & technology curricula materials in terms of structure, coherence & continuity as per best international practices; as well as to investigate the degree such curricula set the stage for integrated science, technology, engineering, and math (STEM) at the middle school level.
- Analysis & Capacity Building (Task 2): Examine the extent to which the new curriculum (all teaching and learning materials) for all subjects at the primary school level are aligned with the basic requirements of accessibility and inclusivity as indicated by Universal Design for Learning (UDL) standards, best practices from multicultural and gender inclusive education, and international guidance on accommodations for students with disabilities.

An abbreviated version of the background, guiding questions, methods, findings, and conclusions of each task team follows. General actionable recommendations across the three task teams are summarized in the joint recommendations section.

Team 1a : Arabic Literacy

The following guiding questions structured the Arabic literacy review process:

TASK 1 – Literacy Alignment
Q1 –What are the innovations in the Arabic curriculum that mark the new primary school curriculum?
Q2- Are there any specific areas of concern in regard to **global best practices** within the *recently revised* **primary school** Arabic literacy curriculum?
Q3- What are the areas of **fidelity and gaps** between the current Arabic **middle school** curriculum and **global best practices** for Arabic literacy curriculum?
Q4 - What are the **gaps**, **redundancies, misalignments, and/or inconsistencies** that exist between the **middle school** Arabic curriculum and materials and the new **primary school** curriculum and approaches?

Review tools and rubrics. The lead experts developed two draft rubrics: a curriculum and instructional design rubric and a best practices rubric (the final versions used in the review are in Annex 1). An additional instructional framework was also developed to support the review of reading instructional practices. All materials were finalized during the capacity building workshops with inputs from MOE participant/reviewers. The rubric is a general, reflectively eclectic collection of the most prominent research-based practices that have had positive effect on students' literacy and reading development. Similar research in Arabic language is quite scarce and what is available is in line with international best practices cited here as well. This review rubric included the following nine standards:

I. Focus on universal values and contemporary issues.
II. Durable, consistent, and harmonious curriculum foundations
III. Student-centered curriculum
IV. Clear and flexible instructional design
V. Inclusive and balanced instructional design
VI. Openness to other subjects and life
VII. Pedagogical, didactic materials, and scaffolding to facilitate teaching and learning processes.
VIII. Alignment with international best practices in teaching and learning language arts
IX. An integrated assessment system

Each standard included four to thirteen indicators, for a total of sixty-six indicators. The curriculum review rubrics (in Arabic and English) are in Annex 1.

Arabic Literacy Conclusions

1. The new primary school curriculum is marked by innovations that are consistent with international standards and evidence-based practices with respect to curriculum design and pedagogical approaches.
2. The curriculum is informed by conceptual frameworks that guide curriculum development and instruction, and ground instruction in research and evidence-based practices. [1]
3. The primary curriculum makes use of evidence and research-based practices that emphasize the importance of teaching early literacy using the phonetic approach, children's literature, and performance indicators that guide the learning, planning and assessment processes.
4. The absence of an overall curriculum framework that informs the design, implementation, and evaluation of textbook content and activities is responsible for gaps, inconsistencies, and weaknesses in the overall curriculum design. Since the curriculum framework and design is the basis for developing, linking, and sequencing teaching and learning materials for all grade levels, the review team concludes without this, teacher guides and textbooks are not optimally designed, nor is content organized in the most beneficial way for teachers and learners.
5. While the curriculum materials address universal values throughout the three years of middle school, include student learning outcomes and competencies, and provide opportunities for teachers to use multiple approaches and methods of teaching, there are gaps in five areas including: integrated pedagogic approach that includes all four part of literacy learning, scope and sequence, coordination of concepts and values (including content), instructional time and student-led practice, technology, assessment and differentiation.
6. There is no systematic process for assessing student's literacy needs and using data obtained to inform instruction for all students, especially for students with specific reading and learning difficulties, which scholars consider essential. [2] The lack of an assessment and instruction process

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[1] Taha-Thomure, H. (2008). The status of Arabic language today. Journal of Education, Business and Society: Contemporary Middle Eastern Issues. Volume 1 (3), 186-192.

[2] Allington, R. L. (2011). What really matters for struggling readers: Designing research-based programs. New York: Pearson Education.

Mokhtari, K., Rosemary, C., & Edwards, P. (2007). Making instructional decisions based on data: What, how, and why. The Reading Teacher, 64 (4), 354-359.

Edwards, P.A., Turner, J.D., & Mokhtari, K. (2008). Balancing the assessment of learning and for learning in support of student literacy achievement. The Reading Teacher, 61(8), 682–684.

makes it difficult for teachers to design and monitor instruction in ways that allow teachers to effectively address students' individual needs, interests, and learning preferences. [3]

7. The Arabic language curriculum and associated materials for primary and middle school need improvement in aligning content, instruction, and student achievement outcomes across the grades.
8. Arabic language curricula for primary and middle school do not reflect a healthy balance (or integration) between content and skills or knowledge and application—i.e., teaching students about language and giving them the opportunity to apply what they learn through meaningful instructional activities and experiences.
9. Textbooks are characterized by an absence of links between the four components of the Arabic language (listening, speaking, reading and writing). The materials do not integrate listening and speaking skills into reading and writing instruction so as to provide opportunities for students to improve oral communication skills and content learning.
10. The Arabic language curricula for primary and middle school do not adequately incorporate the teaching of language skills and subject matter, nor is it properly aligned with assessments.

Team 1b: STEM

The following guiding questions structured the STEM review process:

TASK 1b – STEM Alignment
Q1- To what extent are the science and math primary school curricula aligned with international best practices?
Q2- To what extent are the science, technology and math middle school curricula aligned with international best practices?
Q3- To what extent are the middle school science, technology and math curricula aligned with the new primary school curricula?
Q4- In what ways are the current science & math curricula compliant with integrated science, technology, engineering, and math (STEM) approaches in the primary school?
Q5- In what ways are the current science, technology & math curricula compliant with integrated STEM approaches in the middle school?

Review tools & rubrics. The curriculum review methods undertaken were data-driven, comprehensive, and collaborative with the MOE. The review was designed to capture the various elements that contribute to STEM learning, given that Morocco adopts teaching science, math and technology as separate disciplines. So, while the purpose was to provide recommendations per STEM subjects, the aim was also to provide the MOE a roadmap towards integrated STEM approaches. The review was structured around specific tools and rubrics for each subject, and one for STEM integration, that were finalized in collaboration with MOE participant/reviewers during the STEM curriculum review training workshop and applied in the subsequent review of curriculum.

SCIENCE & TECHNOLOGY

The science & technology curriculum review was facilitated by the several tools, including scope and sequence documents and a findings, conclusions, and recommendations (FCR) matrix created by the team. To assess curriculum, four specific rubrics were developed and applied: Elementary Science; Middle School Science – Life & Earth; Middle School Science – Physical Science; Middle School – Technology. The curriculum review rubric helped reviewers remain focused whilst collecting data

[3] CAST (2018). Universal Design for Learning Guidelines version 2.2. Retrieved from http://udlguidelines.cast.org
Pratt, D. (1994). Curriculum planning: A handbook for professionals. Toronto, ON: Harcourt Brace.
Pinar, W. F. (2012). What is curriculum theory? New York, NY. Erlbaum.

pertaining to the curriculum review guiding questions. Brought together a set of statements under each of the 6 standards in science and 7 standards in technology. Furthermore, the curriculum review rubric guided reviewers to collect data systematically from 3 curriculum resources (Curriculum Directives, teachers' guide books, & student text books).

MATH

Two tools were refined during the workshops and then employed to conduct the math analyses, 1) Math rubric and 2) scope and sequence matrices of math at the primary and middle levels. As noted for science and technology subjects, the scope and sequence matrix for math was similarly developed by the review team in order to appropriately execute the Math rubric fully, i.e. to assess criteria related to the content and progression of learning in the math curriculum. The Math rubric was developed to gather detailed information about the degree to which the curriculum and materials align with best practice math standards. It comprises three components. (1) coverage and balance (2) cognitive competencies, and (3) technology and assessment. Due to discrepancies in content specifications across grade levels, component 1 was considered separately for primary and middle levels. However, components 2 & 3 were generalized for both levels. All three components provide different lenses on which to base a comprehensive analysis and ultimately an informed decision.

STEM INTEGRATION

To review the extent of STEM integrations across subjects and grade levels, two rubrics were developed: 1) An integrated STEM checklist based on the 2018 ICA framework, and 2) scope and sequence matrices developed during the capacity building workshops.

The *Integrated STEM checklist* assesses STEM quality integration and intensity of agreement on seven major categories: (1) a motivating and engaging context, (2) an engineering design challenge, (3) integration of science content, (4) integration of mathematics content, (5) (student-centered) instructional strategies, (6) teamwork, (7) Information technology and communication. The checklist was employed in two ways, namely, to assess the degree of agreement between math, science, and engineering standards with the STEM ICA framework, therefore discerning the quality of STEM integration in the curricula at the primary and middle levels. The checklist also provided professional development guidelines centered around STEM integration, which assisted MOE reviewers in reflecting on potential means to develop overlapping curricular units across content areas.

CONCLUSIONS

Science & Technology

1. Directions of the Curriculum Document were not always accurately and completely cascaded into the teachers' guides, with an even greater gap from Curriculum Document recommendations: in some instances, there were effectively no cascaded directions.
2. The curriculum offered opportunities for students to develop the abilities necessary to do scientific inquiry, yet it did not foster chances for them to design their own scientific investigations around problems they encountered in their daily-lives, which would have deepened their understanding of, and ability to perform scientific inquiry. Inquiry mainly took the form of "cookbook recipes" that limited the utilization of higher order thinking skills.
3. At the primary level, the content of the curriculum was well structured around TIMSS domains and concepts. The scope of the curriculum was strong, yet its sequence showed some gaps especially around earth and space science. At the middle school level, the content of the curriculum showed numerous gaps interrupting the smooth progression of concepts across grade levels.
4. The curriculum catered to assessment *of* learning relatively well. This catering was less evident when it came to assessment *for* learning and was not present in terms of assessment *as* learning. At the middle school level, assessment practices were inadequately structured, lacking the opportunity to adopt a competency-based approach that measures student understanding in complex situations.

Formative assessment was misinterpreted and student self-assessment, including reflective practices, were not noted.

5. The middle school science curriculum showed partial alignment with its counterpart at the primary school level. However, alignment between the physical sciences curriculum in the middle school and the new primary science curriculum is relatively stronger than that of the life & earth sciences.
6. The technology component of the curriculum at the primary level invited students to develop their abilities of technological designs, but was not consistent across grade levels, especially lower grades. At the middle school level, students were required to follow pre-determined steps and established projects, therefore they had few chances to work around problems of interest.
7. The curriculum failed to support students to develop an adequate understanding about the inter-relatedness of science-technology-society triad, therefore creating a gap in advocating for the history of science and developing student understanding of science as human endeavor. Best practices, such as, units that advocated for the history of science, developed student understanding of science as human endeavor, and used scientific inquiry to evaluate the results of scientific investigations and examine evidence were missing or underdeveloped.
8. There was no alignment between technology curricula of the middle and primary school. At the middle school level, a clear gap was detected at grade 7 where no technology curriculum was offered to students at all, curriculum was not offered, even at grades 8 and 9, in some schools at provincial, regional, and national levels. Within each grade level discrepancies and gaps existed: no logical progression across grade levels was noted neither at the level of scope, nor at the level of the sequence of the curriculum. Finally, the technology curriculum did not utilize the same terminology consistently across grade levels.

Math

1. There is a relative misalignment between the best practice approaches and the curriculum resources, which results in disconnect between the curriculum and its resources; efforts to operationalizing the standards in textbooks, alignment with best practices weakens, and this reflects the authors' inability to translate the competencies contained in the Curriculum Document into situations and activities that support the mastery of learning. [4]
2. At the primary level there was not enough emphasis on teaching vital content (such as data organization and processing). The content of the middle level standards, presented by conceptual categories across the math domains portrayed an incoherent view of learning progressions across the curriculum and its supporting material that did not support the development of students' mathematical knowledge, skills, and understanding as proposed by best practice international models.
3. In terms of cognitive processes, there was a need to balance between different cognitive levels providing more opportunities for students to engage in reasoning and using their mathematical thinking in various contexts and across subject areas. There was agreement between the primary and middle level curricula in terms of reliance on employing "knowing" and "applying" cognitive processes rather than "reasoning" and "inference making." These high order cognitive processes require time and practice to develop, thus an early exposure is necessary to build competency and confidence.
4. There was an imbalance and lack of coherence in the conceptual progression and sequencing of content required in approaching and constructing math concepts from primary to middle level. The expansion of math concepts from primary to middle levels was weakly aligned with students' cognitive development and the logical structure of mathematics. Therefore, grade-level coordination of standards across domains or conceptual categories was insufficient.

[4] Blackburn, G. (2020). Skill mastery with competency-based learning. https://elearningindustry.com/skills-mastery-with-competency-based-learning-part-1

5. Technology integration was almost absent in both levels due to the lack of instructional activities that promoted explorations using digital and technological tools. The curriculum lacked systematic virtual extensions that enable the facility to combine thinking practices on mathematics, technology, exchange of experiences and project-based learning in the math classroom.
6. The absence of compatibility between the competency-based approach to assessment and the evaluation standards does not allow accurate monitoring of mastery learning and the acquisition of math competencies.
7. Lack of consistency between instructional methodologies adopted at the primary and middle levels, with sudden shifts from concrete, context-based approaches to abstract, decontextualized experiences. Research on best practice international models have identified developmental sequences or learning trajectories along which children develop and a set of instructional activities that help children move along that path. [5] Therefore, well-structured and consistent instructional activities are necessary to help students develop specific mathematical abilities and acquiring behavioral milestones along these trajectories.

STEM Integration

1. There were discrepancies between opportunities provided in the Curriculum Document that adopted the investigative approach in science teaching, and the opportunities in the learner's textbooks. Notably, the strong endorsement of student-centered educational strategies by the Curriculum Documents supported the framework of the competency-based approach. However, no detailed specifications were provided on how to incorporate these guidelines in teaching and learning materials.
2. Similarly, the benefits of contextual integration of science and mathematics contents across the six grades was recognized in the Curriculum Directives, but aspirations were not operationalized in learning materials.
3. The correlated nature of science and math concepts at the primary level and the possibility of harnessing cross-cutting math concepts such as data organization and measurement in science teaching, remained unexploited terrain. Disparity in instructional programming, sequencing, and organization of subject units across subjects did not facilitate an organized and smooth implementation of integrated learning across subjects within middle school.
4. Weak stipulations to adopt engineering thinking and design in the curriculum document and its material impeded opportunities to build progressive activities, such as, engaging in engineering design and systematic computational thinking to solve real-life situations - integrated approaches and develop critical and creative thinking skills.
5. Opportunities to introduce integrated STEM concepts to learners were missed, by not linking mathematics and science to ways they could be used in STEM-related careers.
6. Integrated ICT fell short, especially with digital technologies that could have supported the inclusion of multimodal representations that respond to students' diverse needs and interests, and maximize cooperation and diversification of evidence, solutions and strategies.
7. Learning materials were ultimately unable to provide real situations that might motivate curiosity in STEM and foster a sense of belonging among students through team-based approaches to solving real world challenges.

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[5] Clements & Sarama (2009). Learning and Teaching Early Math: The Learning Trajectories Approach, Routledge, p. viii.

Team 2 : Inclusive Education

The following guiding questions structured the Inclusion and Accessibility review process:

TASK 2 – Inclusive Education
Q1 – In the curriculum for primary grades (1 through 6), how do the Teaching and Learning Materials (TLMs); that is, the learning/teaching strategies, learning content, activities, assessment, etc., align with the Universal Design for Learning (UDL) framework? How do the TLMs align with the following UDL principles? ● Multiple modes of presentation? [6] ● Multiple modes of expression? [7] ● Multiple methods of engagement? [8] **Q2** – In the curriculum for primary grades (1-6), how do the TLMs promote equity and inclusion for all students considering the diversity of the Moroccan student population (i.e. students with disabilities, female students, ethnic and cultural minorities, second language learners)? Q2a. How do the TLMs align with the principles and practices of multicultural education? [9] Q2b. How do the TLMs align with equity and equality principles for gender and disability? [10]

Review tools and rubrics. To meet the diverse needs and characteristics of students, UDL essentially calls for the curriculum to include multiple modes and means in the design of each of these three building blocks of learning. Subsequently, and to help examine the alignment between the curriculum and UDL, the review team developed the UDLCA rubric; a purposefully designed tool that facilitated the review of the different curriculum teaching and learning materials (TLMs) across the different school subjects and grades. This rubric included three sections – in line with the UDL three principles: multiple modes of representations, multiple modes of expression and multiple modes of engagement. The development of the UDLCA was based on reviewing the literature on UDL, where indicators on UDL-based curriculum were identified for each of the three UDL principles and framed in 18 statements that assess the extent to which the curriculum align with those indicators on a four-point Likert scale. The design of the UDLCA rubric also allowed for the collection of qualitative data that allowed the curriculum reviewers to provide examples and comments against each of the rubric statements.
In response to the second guiding question, the assessment of the inclusivity and accessibility of the curriculum focused on examining its alignment with the principles of multicultural, gender and disability education. The review team developed the Equity and Diversity Review Rubric (EDR). The aim was to examine whether the curriculum in terms of content, design and pedagogical approaches was inclusive of all learners; including those of diverse socio-cultural backgrounds, gender and abilities. The EDR tool

[6] "Multiple modes of representation" refers to presenting learning materials in different ways (e.g. experience Drama, video, drawings, Concrete presentations (e.g., Legos, blocks, models) PowerPoint). Source: Tichá, R., Abery, B., Johnstone, C., Poghosyan, A., & Hunt, P. (Eds.) (2018). Inclusive Education Strategies: A Textbook. Minneapolis, MN, USA: University of Minnesota; Yerevan, Armenia: UNICEF Armenia & Armenian State Pedagogical University.
[7] Multiple modes of responses refer to providing students with the to respond to the learning contents/skills in various ways (e.g. drama, artwork, oral reporting, written essay, poems, songs, PowerPoint presentations, etc.). Source: Ibid.
[8] "Multiple methods of engagement" refers to increasing students' motivation by providing them with different ways to engage with the specific learning content/skill (e.g. experiential learning, choices, self-assessment, peer-assessment, etc.). Source: Ibid.
[9] Specifically, whether the learning content (reading texts, characters in the content, examples and activities) are reflective of the whole Moroccan population (i.e. that TLMs reflect gender, ethnic, and other groups).
[10] Including a review of what accessibility formats the Arabic Language curriculum learning materials are available in (i.e. levelled readers, Braille, large print, Moroccan Sign Language), the extent to which the curriculum provides flexibility in terms of time, methods of assessments, and responses to students with disabilities, Arabic second learners, girls, and any other marginalized groups.

was purposefully designed to assist the review of the selected TLMs across the different school subject and grades.

CONCLUSIONS

Alignment with UDL Principles

1. The teaching and learning materials (student textbooks and teacher guides), do not align to a great extent with the UDL principle of multi modes of presentation. This in large is due to the misalignment between the Educational Directives 2020, which emphasizes the use of multi modes of presentations and diverse pedagogical approaches, and the learning content that is presented in both the teacher guide and student textbooks. While the theoretical part of the teacher guides does introduce diverse and effective learning approaches, these are not modeled in the lessons and learning content from which teachers develop and implement lesson plans.
2. The modes of presentations used in the curriculum focus largely on the visual presentations (mainly pictures in student textbook), and much less on other modes such as auditory and hands-on activities and real-life.
3. The comprehensive vision that the written curriculum would incorporate the available digital resources in order to enrich the different modes of presentation, has not been effectively implemented in the teacher guide or student textbook.
4. Teaching and learning materials moderately align with the UDL principle "multiple modes of expression," as they rely largely on visual and auditory expressions with limited adaptation of learning and assessment activities that require kinesthetics expressions.
5. The learning and assessment activities are also characterized by independent learning with limited opportunities for group or collaborative work. However, the learning and assessment activities do not take into consideration the diverse characteristics and needs of the learners (i.e., those who have disability or come from diverse cultural background), and the teacher guides provide little guidance to support teachers catering for the diverse needs of the different learners.
6. The learning and teaching materials do not provide students with opportunities to engage with learning in different modes. Activities that include collaborative learning, learning through play, practical and real-life experiences, peer learning, self-assessment are limited in the curriculum.
7. Limited attention is given to differentiated learning and individual differences in the teacher guides and student textbooks.

Alignment with Multicultural Education, Gender, and Disability

1. The alignment between the curriculum TLMs and the different practices of multicultural education is, to a great extent, limited. The curriculum characters, in both learning content – especially pictures within lessons - do not reflect the cultural, social and language diversity of the Moroccan society.
2. The learning content provides learners with limited opportunities to learn about the historical events and the cultural characteristics and achievements of the different social, cultural groups in the society.
3. Despite acknowledging the language diversity in the Moroccan society, the teacher guides do not provide teachers with guidance on how to support second language students and ensure they are provided with equity learning opportunities.
4. The curriculum content and pedagogical approaches provide limited opportunities that would teach students how to respect ideas that are different to theirs and respect others' points of view.
5. Gender equality appears in the TLMs, to great extent, in the equal use of both feminine and masculine pronouns but appears to a lesser extent in the number of female and male characters depicted in the curriculum. Yet, the stereotypical image of women – one that depicts their limited abilities and capacities to participate and contribute to the different social and scientific fields and carry on leadership and decision-making roles - persists across the curriculum materials.

6. The framework and guide on inclusive practices and their implementations are available to schools and teachers in Morocco, but provided separate from the mainstream curriculum TLMs, an issue that is seen as an obstacle toward achieving a full and effective inclusion of students with disabilities.
7. The TLMs occasionally make, in few instances, references to people with disabilities through some pictures or reading texts, but with few discussions of the roles and contributions of people with disabilities to society, which would help students to develop positive attitudes toward people with disabilities.

RECOMMENDATIONS

All three task teams encourage the Ministry to **appoint a special commission related to each review area.** That is, **a Literacy Curriculum and Instruction Commission** to guide the revision and implementation of an evidence-based Arabic Language and Literacy Curriculum across grades one through nine; a **STEM Commission** that guides the revision and implementation of integrated STEM approaches in the curriculum across grades one through nine; and, an **Inclusive Curriculum and Instruction Commission** that guides the revision and implementation of an inclusive curriculum, especially focused at the primary school level.

The review teams recommend that the composition of each commission be based on each review area. For example, Commissions might include: school system and school leaders, teacher educators, inspectors, textbook authors, educational researchers, other curriculum experts, and parents. The Inclusive and Accessible (Task Team 2) also recommend including civil society organizations that are involved in supporting the education of children with special learning needs and those that support multicultural and gender education. Each of the commissions is recommended to be diverse in terms of their members' gender, social and cultural background, and include people with disabilities. All review teams recommend that the MOE participant/reviewers who took part in the CCA be invited to participate based on their ability to support the translation of the findings, conclusions, and recommendations of this report into actionable next steps.

Each task team identified targeted priorities for each Commission to address, these are as follows.

TEAM 1a – Arabic Literacy
The top priorities for the **Literacy Curriculum and Instruction Commission** include:

I. Develop a Scope and Sequence.
II. Establish a set of universal themes and concepts.
III. Adopt and maintain a curriculum design framework.
IV. Institutionalized accommodations and assessments systems for all learners.

TEAM 1b – STEM Subjects and Integration
Top priorities for the STEM Commission include:

I. Improve consistency in instructional programming across the curriculum.
II. Modify subject-specific content.
III. Incorporate learner-directed problem solving for STEM subjects.
IV. Shift curriculum to integrated STEM.
V. Improve assessment methods.
VI. Train up: Effective STEM methods for curriculum developers and teachers.

TEAM 2 – Inclusion and Accessibility
Top priorities for the **Inclusive Curriculum and Instruction Commission**:

I. Ensure a comprehensive and appropriate alignment between the Educational Directives 2020, and the implementation of UDL's three principles
II. Develop a framework that ensures curriculum alignment and implementation of practices and principles of multicultural, gender, and disability education

ACTIVITY OVERVIEW

GENERAL INTRODUCTION & CONTEXT

In preparation for United States Agency for International Development (USAID)/Morocco's new Country Development and Cooperation Strategy (CDCS), the Education office sought support in conducting analyses and research that would generate necessary data for the development of its new strategy and activities in support of the Moroccan Ministry of National Education, Vocational Training, Higher Education and Scientific Research (MOE). It is anticipated that the next phase of education programming will focus on building the capacity of the MOE to be more able to independently implement and sustain programs. To prepare for this transition, three key analyses that build the foundational evidence to information future activity design in the area of Basic Education support for Morocco were prioritized:

- Analysis & Capacity Building (Task 1a): Examine primary and middle school reading and Arabic curricula, materials, and structure to identify gaps at the middle school level and highlight areas where alignment across grades is needed.
- Analysis & Capacity Building (Task 1b): Examine primary and middle school science, math & technology curricula materials in terms of structure, coherence & continuity as per best international practices; as well as to investigate the degree such curricula set the stage for integrated science, technology, engineering, and math (STEM) at the middle school level.
- Analysis & Capacity Building (Task 2): Examine the extent to which the new curriculum (all teaching and learning materials) for all subjects at the primary school level are aligned with the basic requirements of accessibility and inclusivity as indicated by Universal Design for Learning (UDL) standards, best practices from multicultural and gender inclusive education, and international guidance on accommodations for students with disabilities.

These efforts were designed to build MOE staff capacity by using MOE participants as reviewers who could use this training as the basis for conducting specialized curriculum reviews in the future. This report also provides clear recommendations for the MOE and other educational stakeholders, as well as USAID as it prepared to update the Moroccan CDCS strategy in 2021.
This study first presents the overarching process of completing these participatory workshops and curriculum reviews and then includes a chapter devoted to the specific background for each review, including theories and frameworks on which training workshops – and subsequent curriculum reviews were rooted. These task-team chapters included detailed findings, conclusions, and recommendations. Finally, a prioritized list of recommendations from across the review teams contextualizes recommendations amongst the three reviews for the MOE.

ACTIVITY DESIGN AND METHODS

The activities under Tasks 1a, 1b, & 2 were participatory in design starting from the study team that combined global experts as lead facilitators and Moroccan experts as participants who joined the study team post-training. Each sub-team included five to eight Moroccan education specialists, MOE staff, researchers, and newly trained primary level inspectors. Participants underwent training through remote workshops led by global experts, then participated fully as curriculum reviewers in the three subsequent curriculum reviews. The workshop training and curriculum process followed a uniform process, with modifications to accommodate each subject/s under review, the availability of teaching and learning materials, curricular standards and scope and sequence documents for the subjects reviewed, and existing capabilities of workshop participants. The Analysis Matrix by Task Team (Table 1) presented below includes the guiding questions for each team, as well as the data sources used in their curriculum review and an overview of the tools that guided each review. Following this, the training and curriculum review process for of the three sub-teams is elaborated.

Table 1. Analysis Matrix by Task Team

TASK 1 – Literacy Alignment	Data Sources	Analysis Methods
Q1 –What are the innovations in the Arabic curriculum that mark the new primary school curriculum? **Q2-** Are there any specific areas of concern in regard to **global best practices** within the *recently revised* **primary school** Arabic literacy curriculum? **Q3-** What are the areas of **fidelity and gaps** between the current Arabic **middle school** curriculum and **global best practices** for Arabic literacy curriculum? **Q4** - What are the **gaps**, **redundancies, misalignments, and/or inconsistencies** that exist between the **middle school** Arabic curriculum and materials and the new **primary school** curriculum and approaches?	Literature on Arabic teaching and learning, curriculum review theory and process, and teaching practices for reading have been reviewed to produce draft rubrics for this analysis. The following materials from Reading and Arabic subjects across grades 1-9 will be reviewed: ● Textbooks ● Teacher guides ● Curriculum materials ● Assessment materials (if not otherwise included within curriculum materials)	1. *Curriculum and Instructional Design Review Rubric*: Evaluates key curriculum and instructional design elements 2. *Best Practices Rubric*: Guidance for reviewers on effective practices relative to literacy and its teaching 3. *Gradual Release of Responsibility Framework*: Assesses if curriculum helps teachers to organize instruction and document progress in student learning and engagement. - *Rubrics included in this design report will be finalized with participants' inputs during the remote capacity building workshops*
TASK 1b – STEM Alignment	**Data Sources**	**Analysis Methods**
Q1- To what extent are the science and math primary school curricula aligned with international best practices? **Q2-** To what extent are the science, technology and math middle school curricula aligned with international best practices? **Q3-** To what extent are the middle school science, technology and math curricula aligned with the new primary school curricula? **Q4-** In what ways are the current science & math curricula compliant with integrated science, technology, engineering, and math (STEM) approaches in the primary school? **Q5-** In what ways are the current science, technology & math curricula compliant with integrated STEM approaches in the middle school?	Literature on Science, Technology, Math & STEM teaching and learning, curriculum review theory and process, and teaching practices will be reviewed to produce draft rubrics for this analysis. The following materials from Science, Technology & Math across grades 1-9 will be reviewed: ● Textbooks ● Teacher guides ● Curriculum materials ● Assessment materials	● *Math Rubric:* Evaluates key curriculum and instructional design elements & best practices. ● *Science Rubric:* Evaluates key curriculum and instructional design elements & best practices. ● Technology Rubric for evaluating Middle school technology. ● Scope & sequence documents to ensure coherence and continuity of the curricula (Math, Science & Technology) across Grades 1-9. ● Checklist for comparing the ways current science, math & technology curricula are conducive for integrated STEM.

		Rubrics & checklists will be finalized with participants' inputs during the remote capacity building workshops
TASK 2 – Inclusive Education	**Data Sources**	**Analysis Methods**
Q1 – In the curriculum for primary grades (1 through 6), how do the Teaching and Learning Materials (TLMs); that is, the learning/teaching strategies, learning content, activities, assessment, etc., align with the Universal Design for Learning (UDL) framework? How do the TLMs align with the following UDL principles? ● Multiple modes of presentation? [11] ● Multiple modes of expression? [12] ● Multiple methods of engagement? [13] **Q2** – In the curriculum for primary grades (1-6), how do the TLMs promote equity and inclusion for all students considering the diversity of the Moroccan student population (i.e. students with disabilities, female students, ethnic and cultural minorities, second language learners)? Q2a. How do the TLMs align with the principles and practices of multicultural education? [14] Q2b. How do the TLMs align with equity and equality principles for gender and disability? [15]	Literature on inclusive, multicultural, gender inclusive education, curriculum review theory and process, and teaching practices and theory for inclusive and accessible learning, have been reviewed to produce draft rubrics for this analysis. The following TLMs from all subjects across grades 1-6 will be reviewed: ● Textbooks ● Teacher guides ● Curriculum materials ● Assessment materials (if not otherwise included within curriculum materials)	1. *The UDL Curriculum Alignment rubric (UDLCAR)*: Evaluates extent to which the curriculum aligns with UDL principles designed to serve all learners regardless of ability, gender, cultural and linguistic background. 2. *The Equity and Diversity Review rubric (EDRR)*: Evaluates extent to which curriculum aligns with principles and practices of multicultural, gender and disability education. - *Rubrics included in this design report will be finalized with participants' inputs during the remote capacity building workshops*

[11] "Multiple modes of representation" refers to presenting learning materials in different ways (e.g. experience Drama, video, drawings, Concrete presentations (e.g., Legos, blocks, models) PowerPoint). Source: Tichá, R., Abery, B., Johnstone, C., Poghosyan, A., & Hunt, P. (Eds.) (2018). Inclusive Education Strategies: A Textbook. Minneapolis, MN, USA: University of Minnesota; Yerevan, Armenia: UNICEF Armenia & Armenian State Pedagogical University.

[12] Multiple modes of responses refer to providing students with the to respond to the learning contents/skills in various ways (e.g. drama, artwork, oral reporting, written essay, poems, songs, PowerPoint presentations, etc.). Source: Ibid.

[13] "Multiple methods of engagement" refers to increasing students' motivation by providing them with different ways to engage with the specific learning content/skill (e.g. experiential learning, choices, self-assessment, peer-assessment, etc.). Source: Ibid.

[14] Specifically, whether the learning content (reading texts, characters in the content, examples and activities) are reflective of the whole Moroccan population (i.e. that TLMs reflect gender, ethnic, and other groups).

[15] Including a review of what accessibility formats the Arabic Language curriculum learning materials are available in (i.e. levelled readers, Braille, large print, Moroccan Sign Language), the extent to which the curriculum provides flexibility in terms of time, methods of assessments, and responses to students with disabilities, Arabic second learners, girls, and any other marginalized groups.

OVERALL TRAINING AND REVIEW PROCESSES

1. *Desk review.* Reports and literature relevant to global best practices related to each task have been adapted into the curriculum review process and incorporated into each tasks' training design.
2. *Draft of rubrics and review tools.* The task teams will use educator-developed review tools, evidence guides (e.g., relevant research, policy, and practice reports), and processes (e.g., review and feedback loops with participants and MOE staff) that will enable the task teams to implement an evidence-rich, comprehensive, and eclectic approach to curriculum review.
3. *Production of training content.* Training materials and resources will be developed and compiled for their use in the training.
4. *Distance learning capacity building training.* Before the training, participants will be introduced to the training team and the training platform, Microsoft Teams. Participants will be provided information on the training process and diagnostic testing will be initiated in advance of the training to determine participants' existing competencies in curriculum review and the subject of their respective review. **Remote formal training sessions will extend eight days with approximately 2.5 – 3 hours of training every day.** During the training, each task team will finalize all review rubrics and align on a process for their use in each task teams' review, which will be undertaken by training participants who will serve as curricula reviewers.
   Training logistics:
   a. **Online platform.** Task teams will work with a Microsoft Teams specialist to ensure all needed functionality for remote training, web-recording, breakout sessions, group messaging capabilities, etc. are available for the task team to collaborate amongst team members and with participants.
   b. **Training materials.** An illustrative list of training materials includes digital copies of handouts, translation services for materials, and possible recording of sessions for revision and quality assurance.
5. *Curriculum review.* Each task team will examine a sample of curricula and materials for every grade and indicator independently, as applicable to each task on a set schedule over the course of several weeks. **Participants/Reviewers will lead a review of all teaching and learning materials, which is expected to require 16 hours of work per week for a period of approximately six weeks.** During the curriculum review process, task teams – trainers and reviewers - will (remotely) meet weekly to share and discuss findings, come to consensus on scoring of rubrics and calibrate findings. Teams may also opt to connect regularly via WhatsApp or other messaging technology.
6. *Findings, Conclusions, and Recommendation (FCR) introductory meeting.* At the mid-point of the formal period of curriculum review and weekly meetings, each task team, including reviewers, will (remotely) meet for an initial reporting out of preliminary findings. During this meeting, the teams will be introduced to the analysis process that will be used to reach a unified conclusion about the strengths, challenges, and recommendations of the curriculum materials.
7. *Analysis and Writing.* A full analysis will be developed following reporting out meeting, after all materials have been reviewed. This analysis, in the form of a final FCR matrix in Arabic, will form the basis of a final written report that will incorporate findings, conclusions, and recommendations from task teams. **It is estimated that the process from introduction of the FCR to a final version of the FCR Matrix at the conclusion of the review of materials, will take approximately three weeks, requiring approximately 2-4 hours of reviewers' time per week.** The FCR will be translated into English and adapted to the final report by the team of lead experts for each sub-task team.
8. The production of the final written report will the responsibility of Social Impact (SI) and the training teams.

WORKSHOP DESIGN

Each of the task teams conducted training workshops covered general and specialized content necessary for the subsequent curriculum reviews. [16] The general schedule is summarized below, with examples from the Arabic Literacy Team. The curricular materials developed for each workshop (in Arabic) are housed on Google Drive and there will be open access for future trainings or to guide future curriculum reviews. An objective of each training was for task teams, trainers and participant/reviewers, to refine draft rubrics into a final, agreed on version of the tools on which to base the review of curricular materials, as well as alignment on the specifics of the review process undertaken by teach team. The final versions of all rubrics are available in Arabic and English (Annex 1).

Table 2. Reading Core Training Content Overview

Module	Title	Learning Objective
1	Introduction to training and curriculum review activity	To discuss and reflect on reading as the core of all learning.
2	Introduction to Curriculum review process	To gain understanding and reflective awareness of the curriculum review processes.
3	Curriculum review plans, where to start?	To design an initial curriculum review plan
4	What to look for?	Analyzing Data collected in a curriculum review
5	What is Alignment in curriculum and how to develop a framework for curriculum review?	a. To develop a plan for the upcoming curriculum review that includes global best practices and program alignment. b. To reflect on all the elements that need to be considered when analyzing curriculum alignment. c. To build a framework for a reading curriculum review.

Note: Throughout all modules the training included ice breakers & hands-on activities, using actual materials from the Moroccan Arabic curriculum during synchronous interactions.

ASSESSMENT OF PARTICIPANT/REVIEWERS

All three sub-tasks were fully participatory, starting as capacity building workshops and practicum-style learning experiences, leading to participants serving as co-curriculum reviewers alongside the task teams' experts. Participants in the capacity building workshops entered training as specialists within the field of education but were not necessarily knowledgeable about curriculum review, nor the subjects of these specialized reviews. That is, for Task 1a - Arabic Literacy, participants had varying degrees of experience with reading alignment and the scope and sequence expected of learners.

Therefore, measuring the progress participants made in the project was of immense value. Not only did this give an indication of whether the training achieved its stated goals, but it also ensured that training and follow-up could be adjusted to meet the participants' needs depending on what data collected from the assessments revealed. This was important to ensure the training built on participants existing

[16] Workshops for each task team were held during different months: Team 1a: June 2020, Team 2: July 2020, Team 1b: October 2020.

knowledge. The training design therefore asserted that participants followed an assessment cycle that included a pre-test, continuous assessment, and a post-test followed by supplemental training when and where needed.

PRE-TEST

This pre-training phase included a battery of tests (specific to each task team) that the participants were asked to do including:

1. *Educational Agree/Disagree Statements Activity:* This was an activity that included several educational statements linked to best practices in reading. Participants answered whether they agreed with it or not and gave reasons why. This piece formed an entry point into the training as it gave the trainers an idea of what perspectives the participants come from on teaching reading, inclusivity, math, science, technology, or STEM. It was a focal discussion element in subsequent trainings.
2. *Reviewing a sample unit (with no guiding questions/rubric):* The trainers suggested the initial rubrics to use for the curriculum review and alignment exercise, then participants had to take them and build from that a curriculum review framework/rubric that was in line with the Moroccan context and with global best practices, and were required to share with the trainers for feedback, discussion, and common vetting.
3. *Reviewing a sample unit with some guiding questions:* The participants had to review a unit (real or hypothetical – based on each teams' method of testing) but with the guidance of questions that could help them focus on the most pertinent aspects of that units' teaching & learning.

CONTINUOUS ASSESSMENT DURING TRAINING

Participants wrote short reflections and/or completed brief surveys after each session attended. The reflection/survey was shared with the facilitator who was able to discuss points raised at the next training session. Participants moved from being participants to being reviewers on an individual basis through the two weeks of the training. Any participant who proved via the pre-test and continuous assessments that they are ready to move on to a role of reviewer were given independent review tasks (which were reviewed for quality and interrater reliability purposes) from that point. This meant that an "at your own pace" approach was used to ensure that all participants were being catered to according to their readiness level.

POST-TEST

All participants took a post-test task similar to the pre-test task, which included:

1. *Educational Agree/Disagree Statements Activity:* Participants, who should have been by this time reviewers, took the test again and then compared the post-test results with pre-test results and discussed reasons for the changes of mind they had and contextualized it within the training framework.
2. *Building a framework for a curriculum review:* Participants had to take the draft rubrics and build from that a curriculum review framework/rubric that is in line with the Moroccan context and with global best practices and then share with the trainers for feedback, discussion, and common vetting.
3. *Reviewing a Reading unit using the co-created framework:* The participants were then given a random (or hypothetical) unit that they had to review once the training ended. They used the co-created framework to do this task.

FOLLOW-ON QUALITY ASSURANCE AND SUPPORT

For a period of six or more weeks following the workshops, teams held weekly meet ups to discuss and reflect on:

1. Curriculum review and alignment progress.
2. Areas where more training is needed.
3. Lessons learned from the development process that could inform other curriculum development processes and methodologies in the future.

CURRICULUM REVIEW ANALYSIS METHODS AND REPORT WRITING

The curriculum review was kicked off during the remote training workshops conducted by each task team. The trainings were designed to build participants' abilities by gradually shifting to independent review of materials, with continued remote support of the training team, after the official training workshops.

As indicated in the training design, the lead curriculum reviewer, with collaboration of the training team, developed a weekly schedule for each reviewer, or each pair of reviewers, that clearly outlined expectations for the review and the rubric and/or other tools that should be used to systematize the review process reliably across reviewers as part of the training workshops. Additional details on the analysis process, e.g. how rubrics were to be tallied, how weekly observations of new findings would be cumulatively collected - and at what intervals, how preliminary findings will be reviewed, discussed, and documented to begin building initial conclusions and recommendations were all finalized during each task team's capacity building training.

Participants, once graduated to the status of reviewers, were assigned materials for review weekly and were expected to complete the relevant rubrics in advance of the task teams' weekly progress meetings. Any shortfall in meeting the schedule for reviewing materials was noted and problem solved as a team in these weekly calls – so that participants/reviewers continued to move to the next week's scheduled materials for review to remain on schedule. The team lead was updated weekly on progress and plans during this review period.

The team of trainers and reviewers for each task regrouped (virtually) for analytic FCR drafting meetings after all curriculum and materials related to each task had been reviewed. Reviewers also held internal meetings to finalize key findings, conclusions, and recommendations. The objective of the reporting out meetings was to allow a forum for discussing key findings that emerged during the curriculum review and to document these findings in a preliminary FCR matrix. The FCR matrix was refined and validated by the lead curriculum reviewer with support of the full training team and formed the foundation for each tasks' respective draft and final reports.

Report Writing. The task teams produced this one final report that includes specific background details, as well as findings, conclusions, and recommendations covering Tasks 1a, 1b & 2. The findings are written from the perspective of reviewers, as these were the individuals who conducted much of the review (under expert guidance) and analyzed the findings to reach the conclusions and recommendations in this report. Task Team 2 has also produced a stand-alone toolkit with guidance for future curriculum developers that incorporates best practices in designing accessible and inclusive curriculum (Annex 2). This toolkit is based on the frameworks that guided their curriculum review. The final rubrics used by each task team are included in Annex 1. All guiding questions are addressed with an analysis across grade levels leading to recommendations towards an overall alignment of the curricula across the primary and middle school levels.

LIMITATIONS

COVID-19 and remote training. Since the SOW was finalized for this activity the world around us has changed dramatically. The task teams were selected for their ideal composition as teams of three experts with a range of language skills and geographic locations to best serve the goal of in-person training. However, at the design report stage, the full team has adjusted to the reality that the capacity building trainings, full curriculum review, and reporting out meetings will all take place remotely. The activity team has brought onboard additional support staff, Microsoft Teams specialist, as well as translation and interpretation support that be believe will enable this activity to be executed well remotely. However, this shift introduces language and logistical challenges, as well as the potential to shift timelines to ensure participants receive the equivalent experience of in-person training. The team believes these risks have been largely mitigated due to creativity and flexibility on the part of the task teams, USAID, and the MOE.

Participants as curriculum reviewers. When conducting a curriculum review, reviewers would generally be selected based on demonstrated proficiency in the required task. However, in this case, the study is prioritizing capacity building and a participatory learning approach that may increase the risks to conducting the curriculum review thoroughly and in a timely fashion. Steps have been taken to mitigate this risk, including: a plan to accompany participants/ curriculum reviewers with on-the-ground support as well as remote support informally as needed, and formally through weekly check-in calls throughout the curriculum review period. Additionally, each weekly check-in will monitor progress towards the review schedule and the lead reviewer will reflect and plan around any schedule challenges on a weekly basis to eliminate the risk of newly trained reviewers falling behind in terms of the agreed-on review schedule.

TASK 1A- CURRICULUM ALIGNMENT FOR READING

BACKGROUND

Since 2015, USAID has been working with the Moroccan MOE on developing a new curriculum for Arabic language instruction for primary school levels. The Reading for Success (RFS) activities initially aimed to improve the quality of Arabic literacy instruction and materials for early grades only (grades 1-4). The success of the activity led the MOE to request to expand the program to the fifth and sixth grades to ensure the harmonization of curriculum content and materials in the whole primary school cycle.

This report reflects the next phase of discussions with MOE leadership, focused on extending Arabic learning attainments to the middle school level to ensure continued learning among students as they advance through the system. This study therefore examines the existing curricula and instructional approaches; for example, shifts from grammar focused lessons to more explicit Arabic lessons, in the next cycle and provides recommendations of how to harmonize them with the primary level content and structure.

BACKGROUND FOR THE ARABIC LITERACY CURRICULUM REVIEW

During the past several years, USAID has been working with the Moroccan MOE on developing a new curriculum for Arabic language instruction that will help upgrade the teaching, learning, and assessment of reading in the primary, upper elementary, and middle school grades. This curriculum will be implemented nationwide with much effort to be invested in teacher training and textbook and materials publication.

In 2015, [17] following the alarming recent international Arabic language literacy results for students in Morocco, USAID commissioned an external review of the national Moroccan Arabic language curriculum (grades 1-4).

The external review took a global perspective integrating a framework of international best practice not only in textbook design, but in philosophy of education, curriculum design and approaches, assessment practices, universal/enduring understandings, robustness and responsiveness to 21st century skills. The review analyzed the curriculum's logic, stated philosophy, and approach.

A careful analysis of the 2015 edited Arabic curriculum was then undertaken with international best practice as the benchmark especially with regard to standards and performance indicators, instructional resources, pedagogy, and assessment. Based on the analysis done, the 2015 review report recommended short and medium- to long-term recommendations in areas related to scope and sequence, more engagement with MSA, clarifying the learner linguistic profile, including quality children's literature in the Arabic curriculum, increasing Arabic language instructional time, developing a national framework for language teaching, putting more attention into assessment and student support, adopting a literacy coaching framework and integrating Arabic language instruction across disciplines.

GOAL OF THE 2020 CCA ARABIC LITERACY REVIEW

The overall purpose of this Arabic literacy curriculum review is to build on these prior studies, and to help increase the capacity of MOE staff to use evidence-based curriculum and instruction practices to strengthen Arabic literacy instruction and improve student achievement outcomes as they advance through the grades. [18, 19, 20, 21]

The goals of the CCA were to review the primary and middle school curriculum scope and sequence to determine whether modifications are needed to help ensure that evidence-based curriculum and instruction practices are incorporated at each grade level, that content and instruction are aligned across the grades, and that any gaps in the curriculum that might hinder the logical flow between primary and middle school are isolated and addressed. [22]

Specifically, the goals were to:

1. Review curriculum sequencing from grades 1-4 (which have been recently updated), with the objective of developing recommendations to refine grades 1-4 (as needed, then review upper primary grades 5-6 and lower secondary grades 7-9, in order to recommend modifications to ensure best practices are incorporated at each grade level.
2. To harmonize the Arabic literacy curriculum across grades 1-9, so that the study presents recommendations on the progression and structure of learning across grades 1-9 and identifies any gaps in the curriculum that hinder the logical flow between primary and middle school.

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17 USAID (2015). Reviewing the Moroccan national Arabic language curriculum Grades 1-4.

18 International Literacy Association. (2017). Standards for Reading Professionals. Newark, DE.

19 National Institute of Child Health and Human Development. (2000). Report of the National Reading Panel. Teaching children to read: an evidence-based assessment of the scientific research literature on reading and its implications for reading instruction: Reports of the subgroups (NIH Publication No. 00-4754). Washington, DC: U.S. Government Printing Office.

20 Taha-Thomure, H. (2011). Standards-Based Instruction for Arabic Language. Academia International, Beirut.

21 UNESCO (1991). Guidelines and Criteria for the Development, Evaluation and Revision of Curricula, Textbooks and Other Educational Materials in International Education in Order to Promote an International Dimension in Education. UNESCO, Paris.

22 Jacobs, H. editor. (2004). Getting Results with Curriculum Mapping. Alexandria, VA: ASCD.

Task 1a ultimately concluded with the following recommendations on how best to **align** the **middle school** Arabic curriculum with the **primary school** curriculum, and to **improve** the curriculum across the **primary and middle** school grades.

GUIDING QUESTIONS

The following guiding questions structured the review process:

Q1 – What are the innovations in the Arabic curriculum that mark the new primary school curriculum?

Q2 – Are there any specific areas of concern in regard to **global best practices** within the *recently revised* **primary school** Arabic literacy curriculum?

Q3 – What are the areas of **fidelity and gaps** between the current Arabic **middle school** curriculum and **global best practices** for Arabic literacy curriculum?

Q4 – What are the **gaps**, **redundancies, misalignments, and/or inconsistencies** that exist between the **middle school** Arabic curriculum and materials and the new **primary school** curriculum and approaches?

CURRICULUM REVIEW DESIGN AND METHODS

Task Team 1a led the Arabic literacy review rooted in their strong belief that the path to effective reading instruction, in addition to having well trained teachers, requires high quality curriculum materials. Therefore, Task Team 1a, through the workshop training and guided curriculum review ensured that curricula and associated materials were thoroughly scrutinized for indicators of quality, alignment, and implementation. The workshops began with the following review tools rooted in academic literature, theories of language acquisition & Arabic language literacy, and evidence-based best practices in curriculum reviews.

Summary of Curriculum Review Activities. The Curriculum Review team (Task 1a) worked closely with the Morocco CCA team in completing a review of the Arabic and reading curriculum. To this end, Task 1a team participated in a series of remote capacity building training workshops, totaling 24 hours of instructional time, for selected Moroccan MOE staff and inspectors, who then joined Task 1a team to complete a complex, thorough, and rigorous best-practices-based review of the Arabic language and reading curriculum across grades one through nine.

For purposes of this curriculum review, Task 1a team used a series of established curriculum design and review processes consisting of coordinated iterative cycles of curriculum reviews, follow-up discussions and analyses, curriculum review outcome refinements, and report writing. A sampling of these iterative processes follows.

- *Curriculum Development Desk review*. Task 1a team conducted a review of the literature relevant to global research, policy, and best practices and used findings to inform and guide the curriculum review processes.
- *Curriculum Review Rubrics*. Task 1a team developed evidence-based rubrics and review tools (e.g., scope and sequence matrix) informed by relevant research, policy, and practice reports to enable us to implement an evidence-rich, comprehensive, and eclectic approach to curriculum reviews.
- *Production of Training Content*. Task 1a team developed four asynchronous professional development modules aimed at preparing a team of five MOE selected reviewers to conduct a

credible review of the Arabic reading curriculum. The team also developed a pre-training diagnostic assessment survey, to be initiated in advance of the training to determine trainees' existing prior knowledge, skills, and dispositions with regard to curriculum development and reviews and a post assessment survey that helped the team measure the progress made and the effectiveness of the training.

- *E-learning capacity building training*. Task 1a team hosted an intensive training course that included 24-hours of instruction over a period of eight consecutive days for five curriculum reviewers. Content of the capacity-building modules focused on (a) Foundations of reading as the core for all learning, (b) Curriculum design and review processes, (c) Preparing to conduct the curriculum review, (d) Using data collected in a curriculum review to evaluate curricula and instruction and to align curricula. All training sessions were conducted using the Microsoft Teams platform and included ice breakers, and a mix of lecture, hands-on curriculum reviews activities using actual materials from the Moroccan Arabic curriculum, and guided discussion.
- *Weekly formal Check*-ins. Prior to, during, and after capacity-building training, Task 1a team met weekly with reviewers to discuss curriculum design questions, issues or challenges, review progress on independent reviews of the Arabic reading curriculum, address issues related to the outcomes of the review process, and reach consensus on curriculum review findings, conclusions, and recommendations.
- *On the go Informal Check*-ins: The whole team had access to WhatsApp which made daily check-ins and on the fly support to the reviewers possible. It allowed for rapid responses to questions that were raised by reviewers and helped keep the process smooth and on target.
- *Report Writing*. At the conclusion of the curriculum review process, Task 1a team conducted a full analysis of the outcomes of the curriculum reviews and prepared a draft report incorporating findings, conclusions, and recommendations.

Additional information about the processes involved in completing a review of the Arabic literacy curriculum can be found in the Morocco CCA Design Report.

REVIEW TOOLS AND RUBRICS

The lead experts developed two draft rubrics: a curriculum and instructional design rubric and a best practices rubric (the final versions used in the review are in Annex 1). An additional instructional framework was also developed to support the review of reading instructional practices. All materials were finalized during the capacity building workshops with inputs from MOE participant/reviewers. The best practices rubric was developed based on a previous rubric developed in 2015 by Hanada Taha who was commissioned by MOE and USAID to review the primary Arabic textbooks. The current grade 1-4 textbooks are meant to be based on the review results done in 2015, grounded in the first iteration of the best practices rubric. The rubric is a general, reflectively eclectic collection of the most prominent research-based practices that have had positive effect on students' literacy and reading development. Similar research in Arabic language is quite scarce and what is available is in line with international best practices cited here as well.

The *Curriculum and Instructional Design Review Rubric* evaluates key curriculum and instructional design elements, including:

1. Content scope and sequence (i.e., whether content is evidence-based and of sufficient scope and sequence).
2. Content alignment (i.e., whether content is aligned with standards within and across grades).
3. Intensity or dose of instruction (i.e., whether content taught is of sufficient quality and quantity).
4. Instructional delivery (i.e., how instruction is organized and delivered).

5. UDL (i.e., whether instructional materials are user-friendly for students and teachers; whether they are likely to help facilitate student learning and enhance teachers' ability to differentiate instruction for students with diverse learning needs.
6. Assessment (i.e., the extent to which progress on student learning is monitored and instruction is adjusted based on the data derived from assessment to meet student needs).

The proposed rubrics were designed to examine the overall quality and usability of the curriculum materials across the grades. To help ensure that teachers whose responsibility is to implement the curriculum, have the tools to do so well, the review team further recommended that an instructional framework be used to help teachers organize and monitor instruction in the classroom. To this end, the *Gradual Release of Responsibility Framework,* [23] (shown in Figure 1) would help teachers organize instruction and document progress with regard to student learning and engagement.

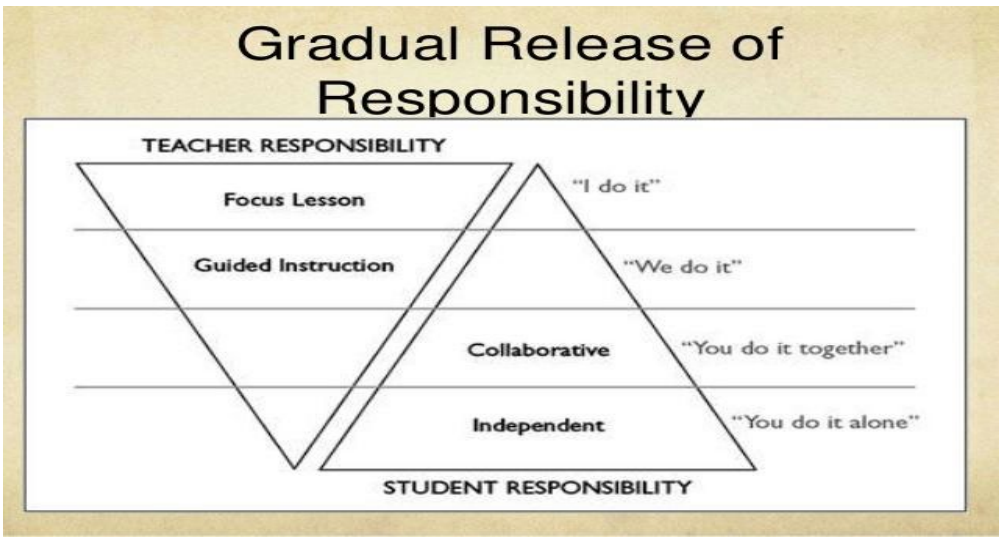

Figure 1: Gradual release of responsibility framework

The rubrics and tools were designed to evaluate the overall quality of the curriculum to help (a) determine the extent to which particular aspects of the curriculum are aligned with research and professional standards, (b) identify gaps in the curriculum, particularly with respect to what students are expected to know and be able to do within each grade, and (c) make recommendations for strengthening the design, implementation, and evaluation of the curriculum materials.

The Arabic curriculum review process, was carried out over a period of seven months, led by a team consisting of three international experts in curriculum and instruction and five curriculum reviewers. Curricula reviewed included 18 textbooks (two textbooks by grade), 16 teacher guides, and two curriculum documents: *Innovations of the primary school curriculum for the school year 2020-2021,* and *Educational programs and directives for the Arabic language instruction in middle school.* The review process was completed in three phases: In phase one, all five curriculum reviewers completed an intensive training workshop aimed at preparing them for the review of curriculum materials. In phase two, reviewers completed independent reviews of assigned curriculum materials under the guidance and consultation of the curriculum development and curriculum review team leaders. In phase three, reviewers drafted a comprehensive matrix outlining curriculum review findings, conclusions, and recommendations. The Arabic version of the matrix was then finalized through a series

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[23] Pearson, P.D., & Gallagher, M.C. (1983). The instruction of reading comprehension. *Contemporary Educational Psychology, 8,* 317-344.

of work sessions led by team leaders. It was then translated to English and refined by the lead experts into the findings, conclusions, and recommendations that follows.

TASK 1A – ARABIC LITERACY ALIGNMENT FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

The analysis of reviewed curricular materials for Arabic literacy resulted in several findings, conclusions, and recommendations organized by each of the four guiding questions for the review. Recommendations for Q1 and Q2 are presented following Q2 as both concern the primary level.

Assessing the alignment between the curriculum materials and the international best practices was the primary goal of this review. Therefore, identifying international best practices based on a review of literature review was the first step undertaken by the Task 1a team. The 1a review team (hereafter, the review team) encompassed the best practices for teaching and learning in general, as well as the best practices related to teaching and learning a language, specifically the Arabic language. During the training workshop the review team gathered and organized these best practices into an exhaustive rubric to facilitate the review of the curriculum materials. This review rubric included the following nine standards:

I. Focus on universal values and contemporary issues.
X. Durable, consistent, and harmonious curriculum foundations
XI. Student-centered curriculum
XII. Clear and flexible instructional design
XIII. Inclusive and balanced instructional design
XIV. Openness to other subjects and life
XV. Pedagogical, didactic materials, and scaffolding to facilitate teaching and learning processes.
XVI. Alignment with international best practices in teaching and learning language arts
XVII. An integrated assessment system

Each standard included four to thirteen indicators, for a total of sixty-six indicators. The curriculum review rubrics (in Arabic and English) are in Annex 1.

QUESTION 1

WHAT ARE THE <u>INNOVATIONS</u> IN THE ARABIC CURRICULUM THAT MARK THE NEW PRIMARY SCHOOL CURRICULUM?

FINDINGS

In line with the "*Innovations of the primary school curriculum for the school year 2020-2021*" document[24] (heretofore referred to as *Innovations*) the review team identified various innovations that are intended to be reflected in the teaching and learning materials at the primary school level. The review team conducted a thorough review of the *Innovations* document as well as a detailed analysis of teacher guides and textbooks to understand whether the intended innovations actually surface in the new curriculum, and the extent to which these are reflected in curricular materials intended for teachers and students.

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[24] Curriculum directorate. (2020). Innovations of the primary school curriculum for the school year 2020-2021. Ministry of National Education, Vocational Training, Higher Education and Scientific Research. Kingdom of Morocco.

> *"... The pedagogical practice in the school and the contents stipulated in the Arabic language programs must start from and return to the child, and consider him a basic partner and a vital actor in the various learning situations and activities." (Curriculum Directorate. 2020. p. 53)*

Beyond adapting a learner-centered approach – which is defined below - the new curriculum incorporates three elements found in a learner-centered curriculum. The three key types of innovations were intended to be integrated with the new learner-centered primary school curriculum, per the *Innovations* document. These innovations were, to varying degrees, reflected in the learning materials reviewed. The innovations were: (1) **pedagogical approaches to teaching language**, (2) **integrates the concept of learning outcomes within the curriculum** and (3) a **focus on learning to read** using techniques that are consistent with international best practices.

Overall, the revised primary curriculum reflects a shift towards learner-centeredness. According to the Curriculum Directorate, it incorporates "unified academic themes that start from the learner ... to expand until they reach more open contexts and themes."[25] Curriculum builds on learners' interests, and all activities and practices are designed to ensure learners' engagement as they build language and literacy skills. This is in contrast to the previous Arabic literacy curriculum that was teacher and textbook centered, depended on rote learning and content knowledge based on memorization.
The review team was able to assess whether teaching and learning materials were learner-centered by examining student textbooks and teacher guides using a *curriculum materials review rubric* that guided the review of the various curriculum teaching and learning materials across grades. By applying these criteria to a selection of textbooks and teacher guides across grades 1-6, the review team was able to find evidence that the revised primary school curriculum demonstrates learner-centered approaches in all materials, although not yet consistently across all materials.

The review team found that the new curriculum engages students in various activities, which provide opportunities to take action and direct their learning through self-feedback via rubrics and other personal assessments that are now staples in the new curriculum. Although teachers still direct and guide student learning, students are the focal point in the new curriculum. For example, every lesson includes texts that ask about students' opinions, feelings, thoughts and reflections. Teacher guides and student textbooks provide teachers with guidance in asking questions before, during, and after reading specific texts to help engage students in expressing their thoughts and feelings, and in reflecting on their understandings. This is in stark contrast to the previous curriculum that was concerned exclusively with content knowledge.

The new primary school curriculum adopts a **pedagogical approach to teaching languages**, with a focus on the transfer of learning and teaching of the Arabic language from a content-based subject to pedagogy-based model. What this means is that language learning requires learners to engage with **all four parts of literacy acquisition: listening, speaking, reading, and writing.** These multiple modes should be integrated in a pedagogical approach to teaching languages. It is considered best

[25] Ibid. P. 30

practice for curriculum to teach content through using evidence-based language and literacy pedagogical approaches and models. [26, 27, 28]

Encouragingly, the Curriculum Directorate guidelines showcase ample evidence for the inclusion of a pedagogical approach to teaching languages. The pedagogical approach is incorporated in *Innovations*, which states that "starting with listening and speaking and gradually moving to reading and writing: it [the school] works first on providing the language verbally and then moves towards reading and writing." [29] Furthermore the guidelines note that "introducing letters in the first year adopted the principle of graduation from simple to complex as a starting point for learning ... " [30] "Making the listening and speaking component an entrance/input to learning (in the first three levels) ...and, Making the reading component an entrance/input to learning the language and giving it a strategic position in the program ... starting from the fourth grade... continue to make the listening and speaking component an entrance/input to learning... and makes the reading component an entrance to learning starting from the fourth grade." [31]

The review team assessed if and how this approach, across all four literacy components, was integrated into teaching and learning materials in the curriculum by using criteria delineated in the Arabic Language Curriculum Rubric (see Standard VII, which delineates research-based practices aimed at supporting effective language and literacy development. The review team assessed if and how this approach, across all four literacy components was integrated into teaching and learning materials in the curriculum by using criteria delineated in the Arabic Language Curriculum Rubric (see Standard VII, Indicator 50), which are grounded in research-based practices aimed at supporting effective language and literacy development. Reviewers determined that while listening, speaking, reading, and writing components are well integrated across early grades textbooks and teacher guides, they are not as well integrated in upper and middle grades curriculum materials. Disintegration was especially pronounced in the review of student textbooks such as *Moufid in the Arabic language*, Grade 7 (see p. 94-97) and to some extent in the grade 8 teacher guide *Mourchidi*, as will be further discussed in Q3 findings.

Pedagogical approaches also encourage the integration of **teaching language skills with other content subjects**. Best practice in language learning supports an integration of teaching of the four language skills across the content subjects of mathematics, science, social studies, and other content areas. [32] [33] Furthermore, literacy scholars state that there should be a greater focus on students' applying language to their overall learning. However, in the review of teaching and learning materials, the team used the Arabic language curriculum review Rubric to help discern if and how Arabic language learning was reflected across content subjects and how language learning was applied to overall learning (see Standard II, Indicators, 6 & 8; Standard V, Indicators 29, 32)) . The review team found that the curriculum shows a lack of integration of the four language skills across the content areas such as mathematics, science, and social studies (see for example *Mounir in Arabic Language* for grade 5, p. 127-149).

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[26] Nutta, J.W., Strebel, C., Mokhtari, K., Mihai, F., & Crevecoeur, E. (2014). Educating English Learners: What Every Classroom Teacher Needs to Know. Harvard Education Press.
[27] Sauvignon, S. J. (1997). Communicative Competence: Theory and Classroom Practice (2nd ed.), McGraw-Hill, New York.
[28] Taha-Thomure, H. (2011). Standards-Based Instruction for Arabic Language. Academia International, Beirut.
[29] Curriculum directorate. (2020). Innovations of the primary school curriculum for the school year 2020-2021. Ministry of National Education, Vocational Training, Higher Education and Scientific Research. Kingdom of Morocco. P. 61.
[30] Ibid. P. 78.
[31] Ibid. P. 86.
[32] Daniels, H., & Zemelman, S. (2004). Subjects matter: Every teacher's guide to Content-Area Reading. Portsmouth, NH: Heinemann.
[33] Donohue, L. (2012). 100 Minutes: Making Every Minute Count in the Literacy Block. Pembroke Publishers.

The review team assessed if and how this pedagogical approach was reflected in teaching and learning materials. Using the Arabic Curriculum review rubric criteria related to instructional strategies and methods, (see Standard II, Indicator 5, and Standard IV, Indicator 20), the review team was able to determine the ways in which the pedagogical approach was enacted in textbooks and teacher guides. For example, the review team found that the teaching of language and literacy skills was not adequately integrated across all student textbooks and teacher guides despite the fact that curriculum integration was emphasized by the Curriculum Directorate.

Furthermore, it is worth noting that the new curriculum adopted the phonics approach to teaching reading, which is a completely new approach in Moroccan schools. Prior to that, students labored over big words and texts that they could barely decode and understand. In contrast, the new Arabic language curriculum is heavily invested in a new approach to teaching essential elements of reading instruction such as phonemic awareness, phonics, fluency, vocabulary and comprehension. "The acquisition of language in the natural context begins with oral use, which requires attaching importance to the necessity of listening and speaking ... as they are essential inputs to language learning. Consequently, oral practice in primary school receives an ample share of teaching and learning time." [34] In addition, consistent with international best practice, a heavy comprehension and children's literature approach were adopted, where students are introduced to developmentally appropriate children's literature in grades 1-3, and that dose increases in grades 4-6, to become the central component of lessons. Excellent textbooks examples that include developmentally appropriate children's literature as a central lesson component are the texts: "stories and dreams" (*Moufid in the Arabic language*, grade 4 textbook, p. 89-90) and "My journey in the digestive system" (*Kitabi in the Arabic language*, grade 2 textbook, p. 66).

A key principle of curriculum design is that it aligns with a scope and sequence that is ideally based on a strong, clear conceptual framework. There is wide agreement that a curriculum scope and sequence is necessary as it helps elucidate what students should know and be able to do at each grade level. These competencies, in turn, help teachers plan, implement, and monitor progress on student learning and achievement. [35] [36] Critical aspects of a scope and sequence are the detailed performance indicators for each grade level that clarify what students should be able to know and do in Arabic. These indicators, often called **learning outcomes and competencies** are calibrated with grade level progression and help textbook developers calibrate the content they design and write to be in alignment with what was expected in each grade level.

The 2020 *Innovations* curricular directive prescribes a competency-based approach to curriculum development "...Drafting a competency at the end of each grade level ... based on the gradual completion of the specifications related to the graduation profile at the end of the primary education level." [37] Using learning outcomes and competencies means that textbook developers have a clear understanding of expected grade level progression, this is in contrast to the previous curriculum, where textbook developers had very high-level overarching guidelines that were open to interpretation. These metrics also clarify teachers' work as they are able, with the new curriculum, to see the whole year's work at a glance and then plan the various activities they need to focus on in order to ensure that students cover the needed performance indicators. In addition, the adoption of clear learning outcomes makes assessing

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[34] Curriculum directorate. (2020). Innovations of the primary school curriculum for the school year 2020-2021. Ministry of National Education, Vocational Training, Higher Education and Scientific Research. Kingdom of Morocco. P. 53.

[35] Fountas, I.C., & Pinnell, G.S. (2006). Teaching for Comprehending and Fluency, K–8: Thinking, Talking, and Writing about Reading. Portsmouth, NH: Heinemann.

[36] Snow, C. E., Burns, M. S., & Griffin, P. (1998). Preventing reading difficulties in young children. Washington, DC: National Academy Press.

[37] Curriculum directorate. (2020). Innovations of the primary school curriculum for the school year 2020-2021. Ministry of National Education, Vocational Training, Higher Education and Scientific Research. Kingdom of Morocco. P. 32.

students more effective. Instead of assessing students using random activities, assessments are linked to the few and clear performance indicators designed for each grade level.

The review team was able to explore how learning outcomes and competencies were structured (or not) throughout the curriculum as intended by the new *Innovations* directive. Specifically, the review considered criteria delineated in the Curriculum & Instructional Design rubric as well as the Arabic Curriculum review rubric to help determine if established assessment practices are meaningfully integrated with expected student learning outcomes and competencies (see Standard IX, Indicators 58, 60, 62-64). The review found that the curriculum lacks a systematic process of assessing student learning and growth (or lack of growth) and for using information obtained to inform instruction for all students, including students who struggle to learn to read and write. The lack of a systematic approach linking assessment and instruction was found across all curriculum materials.

The new curriculum, per *Innovations*, is to adopt a **balanced approach** to teaching Arabic literacy, which incorporates what are considered by leading scholars to be **core literacy practices such as: reading aloud, shared reading, guided reading, and independent reading** to support student literacy development.[38] Other core literacy approaches integrate specific reading comprehensions skills and reading strategies. There are very fine and important distinctions between reading skills and reading strategies. Afflerbach, Pearson, & Paris[39] clarify the fine distinctions that exist between reading skills and reading strategies: a reading *skill* is associated with the proficiency of a complex act such as getting the main idea from a passage, finding an answer to a specific detail in text. A *strategy* is associated with a conscious and systematic plan to engage in a complex act. Strategies are cognitive and metacognitive actions or procedures that help readers make sense of what they read. Examples of such strategies include having a purpose for reading, knowing when and how to use certain strategies when reading comprehension fails, and evaluating one's understanding after reading. Precise distinctions lessen underlying confusion about how these important concepts are used among literacy researchers and practitioners.

The review team examined the extent to which a variety of core literacy practices, delineated in the Arabic Curriculum review rubric (see Standard VIII, Indicators 50-57) were incorporated into the curriculum, particularly in student textbooks and teacher guides. In the curriculum, these practices were highlighted: "Investing in fluency reading skills and building meaning by employing vocabulary and reading comprehension strategies in addition to analysis, synthesis, and opinion on what is read."[40] However, in the textbooks and teacher guides, these skills and strategies were under-utilized. For example, the shared reading was only utilized in the first unit in *Moufid in the Arabic language*, grade 4 textbook while the guided reading was neglected in comparison with other reading practices in *Moufid in the Arabic language*, grade 3 textbook.

Additionally, the review team found that the new curriculum is focused on literacy and reading practices – such as, reading using children's literature is a cornerstone of early literacy. This was consistently observed across the entire sample of the primary and elementary grade materials reviewed. These findings mean that all four types of reading (aloud, shared, guided and independent) were woven into the new curriculum. This is a departure from the old curriculum which focused early on memorization and repetition. According to teacher guides reviewed, students in the new curriculum are to be read to by

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38 Fountas, I.C., & Pinnell, G.S. (2006). Teaching for Comprehending and Fluency, K–8: Thinking, Talking, and Writing about Reading. Portsmouth, NH: Heinemann.

39 Afflerbach, P., Pearson, P.D., & Paris, S. (2008). Clarifying differences between reading skills and reading strategies. The Reading Teacher, 61(5), 364-373.

40 Curriculum directorate. (2020). Innovations of the primary school curriculum for the school year 2020-2021. Ministry of National Education, Vocational Training, Higher Education and Scientific Research. Kingdom of Morocco. P. 97.

the teacher on a daily basis, and are to be engaged in shared reading of short passages written specifically for each age group. In addition, various passages in student textbooks contained stories that incorporate world and Moroccan traditions and folklore. One such example is the text "The Dakka el Marrakchia" (*Kitabi in the Arabic Language*, grade 2 textbook, p. 144) which is a cultural musical tradition unique to Morocco.

Finally, the gradual release of responsibility was an overarching innovation in the new primary curriculum, "Gradual release of responsibility for building instruction from the teacher to the learner." [41] The significance of this approach was highlighted by the review team in designing the review rubrics. In addition to those used to directly review materials, Figure 1, presented earlier, demonstrates the instruction framework that best lends to new pedagogic approaches being taken up by teachers and learners.

CONCLUSIONS

On the basis of the above findings, the review team concludes that the new primary school curriculum is marked by innovations that are consistent with international standards and evidence-based practices with respect to curriculum design and pedagogical approaches. Findings indicate the curriculum is informed by conceptual frameworks that guide curriculum development and instruction, and ground instruction in research and evidence-based practices. [42] The new curriculum makes use of evidence and research-based practices that emphasize the importance of teaching early literacy using the phonetic approach, children's literature, and performance indicators that guide the learning, planning and assessment processes. Evidence examined shows that the new curriculum adopted many innovations that are in line with international best practices.
However, when reviewing the teacher guides and textbooks to determine how these best practice concepts were integrated into the teaching and learning materials, the review team found implementation to be partial and incomplete. Additionally, consistency across all materials and grade levels remains a challenge. For instance, the lack of a systematic approach linking assessment and instruction across all curriculum materials and that core literacy skills and strategies were under-utilized. Therefore, the directive to incorporate best practices has been met, but there remains improvements to ensure these practices are realized at the classroom level.

QUESTION 2

ARE THERE ANY SPECIFIC AREAS OF CONCERN IN REGARD TO GLOBAL BEST PRACTICES WITHIN THE RECENTLY REVISED PRIMARY SCHOOL ARABIC LITERACY CURRICULUM?

KEY FINDINGS

The review team identified two main areas of concern with regard to established evidence-based practices within the recently revised primary school Arabic curriculum.
A primary area of concern pertains to the lack of a **conceptual framework for curriculum design.** In best practice educational systems, a conceptual framework grounds curriculum design and instruction. A good conceptual framework ensures that the many new innovations that are intended for a curriculum are implemented in unison to ensure their maximum effect is realized at the classroom level.

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[41] Curriculum directorate. (2020). Innovations of the primary school curriculum for the school year 2020-2021. Ministry of National Education, Vocational Training, Higher Education and Scientific Research. Kingdom of Morocco. P. 72.
[42] Taha-Thomure, H. (2008). The status of Arabic language today. Journal of Education, Business and Society: Contemporary Middle Eastern Issues. Volume 1 (3), 186-192.

Well-developed conceptual frameworks should ideally include a theoretical approach to teaching and learning, encourage a comprehensive approach that coordinates reading, writing, listening, and speaking skills not only in traditional language arts instruction, but also in the content areas such as social, studies, science and mathematics. It should also provide students with access to diverse texts and resources, as well as opportunities for interaction and practice.[43] [44] [45] [46] When these elements are missing or underdeveloped, teachers struggle to assess learners' progress.

The review team considered the extent to which a **conceptual framework** was evidenced across the design of teaching and learning materials across grade levels. Presence of a conceptual framework was analyzed through extensive discussions with members of the review team using established internal literacy standards for the preparation of reading professionals.[47] Insights gained from this discussion among reviewers were corroborated by examining standards outlined in the Arabic Curriculum review rubric focused on curriculum design and instruction practices (see Standard II, Indicators 5 & 20, and Standard IX, Indicators 58-60). The review team found that the curriculum needs improvement in order to be guided by an overarching conceptual framework for curriculum, instruction, and assessment.

Additionally, reviewers found that without a comprehensive framework the curriculum design of the revised primary school Arabic literacy curriculum fell short of ideal in several areas. As noted above, the curriculum does not seem to be based on an evidence-based theoretical approach to teaching and learning Arabic that enables students to develop communicative competence in the language.[48] [49] The review team uncovered that while the Curriculum Directorate advocates for a theoretical framework for curriculum design and instruction, such a framework is largely absent in teacher guides and student textbooks. As well, the curriculum materials rely more on teaching about language rather than on providing students with unrestrained access to the social, cultural, and pragmatic aspects of language. Language and literacy experts note that greater focus on teaching about language is likely to result in students being grammatically competent but communicatively incompetent.[50] [51] [52]

Finally, the curriculum lacked a sufficiently diverse selection of appropriately leveled texts and passages that permit students to effectively learn to read, write and learn. For example, a majority of student textbooks include a limited number of texts where students have an opportunity for reading and discussion. In a robust curriculum[53] for guidance on selecting and using instructional materials for students with diverse needs and interests), one would expect to find a healthy mix of informational and narrative texts appropriately leveled to meet the language and literacy proficiency needs of all

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43 Fountas, I.C., & Pinnell, G.S. (2006). Teaching for Comprehending and Fluency, K–8: Thinking, Talking, and Writing about Reading. Portsmouth, NH: Heinemann.
44 Snow, C. E., Burns, M. S., & Griffin, P. (1998). Preventing reading difficulties in young children. Washington, DC: National Academy Press.
45 International Literacy Association. (2017). Standards for Reading Professionals. Newark, DE. Author.
46 RAND Reading Study Group. (2002). Reading for understanding: Toward an R&D program in reading comprehension. Santa Monica, CA.
47 International Literacy Association. (2017). Standards for Reading Professionals. Newark, DE. Author.
48 Sauvignon, S. J. (1997). Communicative Competence: Theory and Classroom Practice (2nd ed.), McGraw-Hill, New York.
49 Richards, J. S., & Rodgers, T. S., (2001). Approaches and Methods in Language Teaching. A Description and Analysis, Cambridge University Press, Cambridge.
50 Nutta, J.W., Strebel, C., Mokhtari, K., Mihai, F., & Crevecoeur, E. (2014). Educating English Learners: What Every Classroom Teacher Needs to Know. Harvard Education Press.
51 Sauvignon, S. J. (1997). Communicative Competence: Theory and Classroom Practice (2nd ed.), McGraw-Hill, New York.
52 Snow, C. E., Burns, M. S., & Griffin, P. (1998). Preventing reading difficulties in young children. Washington, DC: National Academy Press.
53 Fountas, I.C., & Pinnell, G.S. (2006). Teaching for Comprehending and Fluency, K–8: Thinking, Talking, and Writing about Reading. Portsmouth, NH: Heinemann.

students. [54] These curriculum design concerns, stemming from the lack of a comprehensive conceptual framework, make it especially difficult for teachers to assess and attend to the needs of students with reading and learning challenges. [55]

The second area of concern pertains to the **overall quality of textbooks and teacher guides.** While there were many best-practices innovations in the revised curriculum, as documented in Q1 findings, there remain concerns about how these innovations are enacted in the textbooks and teacher guides. Reviewers found evidence across all reviewed textbooks and teacher guides' – in terms of both content and activities. To summarize, the key disconnect between intended innovations and their implementation in textbooks and teacher guides includes a lack of a conceptual framework to help guide curriculum design, instructional delivery, and assessment; insufficient sets of diverse and levelled texts to accommodate students with varying levels of language and literacy skills; and the need to incorporate these innovations in a consistent manner across all student textbooks and teacher guides.

CONCLUSIONS

The review team concluded that the absence of an overall curriculum framework that informs the design, implementation, and evaluation of textbook content and activities is responsible for gaps, inconsistencies, and weaknesses in the overall curriculum design. Since the curriculum framework and design is the basis for developing, linking, and sequencing teaching and learning materials for all grade levels, the review team concludes teacher guides and textbooks are not optimally designed, nor is content organized in the most beneficial way for teachers and learners.

RECOMMENDATIONS

In an effort to strengthen the revised primary school Arabic curriculum, the review team recommends that the Curriculum Directorate, alongside multiple stakeholders (experts trained in curriculum review, teachers, inspectors, parents, etc.) – as delineated in the final overarching recommendations, oversee that the development and implementation of the Arabic primary literacy curriculum and associated textbooks and teacher guides are:

(a) informed by a conceptual framework based on established theories of language and literacy development, approaches to child growth and development, and evidence-based instructional best practices,

(b) guided by a developmental scope and sequence framework that specifies what students are expected to know and be able to do along with performance indicators for each grade level,

(c) able to provide students struggling in areas of literacy and Arabic language development by developing an instructional guide with examples and resources to support textbook authors and publishers when writing curriculum materials and to assist teachers in implementing the curriculum in their respective classrooms.

(d) include texts and instructional activities that are diverse, appropriately leveled, and consistent with students' varying abilities, needs, and interests, integrated with all domains of learning and understandable to all stakeholders.

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[54] Ibid.

[55] Allington, R. L. (2011). What really matters for struggling readers: Designing research-based programs. New York: Pearson Education.

(e) closely align content, skills, and competencies taught to local, national, and international assessments used to determine the degree to which students have attained expected achievement outcomes.

Suggestions for **who needs to be involved in these changes** and **how (and when) they can be realized** are included in the general recommendations at the end of the Arabic literacy section.

QUESTION 3

WHAT ARE THE AREAS OF FIDELITY AND GAPS BETWEEN THE CURRENT ARABIC MIDDLE SCHOOL CURRICULUM AND GLOBAL BEST PRACTICES FOR ARABIC LITERACY CURRICULUM?

FINDINGS

The reviewer team identified various areas of fidelity and gaps between the current Arabic middle school curriculum and the established evidence-based practices for the Arabic literacy curriculum. ***Three areas of fidelity*** were found in the curriculum and teacher guides including those pertaining to **values, learning outcomes and competencies, multiple teaching approaches.** The review team found ***gaps in six areas*** including **integrated pedagogic approach that includes all four components of literacy learning, curriculum scope and sequence, coordination of concepts and content, instructional time and student-led practice, technology integration, and assessment.** The areas of fidelity and gaps are explored below, including how the review team assessed their presence (or lack thereof) in the middle school curriculum and what the review uncovered about the current state of the curricular materials.

Areas of Fidelity

Values: The review team examined how values were presented in the curriculum, textbooks and teacher guides. Best practice asserts that curriculum should be based on a set of universal, integrated values that provide a platform on which learners can build knowledge and literacy competencies.[56] To assess how values were included, the review team used insights gained from established research and best practices as well as from standards and indicators outlined in the Arabic Language Curriculum Review Rubric (see Standard I, Indicators, 1, 2, 3, 4), to identify instances where values were used across the curriculum, student textbooks, teacher guides and other curriculum documents. The team also engaged during their regular weekly meetings in spirited discussions about the need for the curriculum to include universal human values such as love, peace, truth, proper conduct, and non-violence.
The review the team found evidence across all materials reviewed that the curriculum contains core concepts and values throughout the three years of middle school, which help prepare students to be responsible citizens. However, there was some dissent among the team from members who felt that the textbooks geared towards the direct instruction or memorization of values instead of giving the students the opportunity to practice them. According to some reviewers this deepened the separation between the school and the real life. Also, for others, the curriculum was not based on universal values. An example is *Assassi in the Arabic language* Grade 9 textbook where there is just a reference on the universal values "by acquiring positive attitudes towards your country, its issues, and humanitarian issues in general"(p.41) but it was not dealt with in the texts of the units.

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[56] Apple M (1979). Ideology and Curriculum. London: Routledge and Kegan Paul.
Dewey J (1943). The school and society. Chicago. University of Chicago Press.
Rokeach M (1979). Understanding human values. New York: Free Press.

Indeed, in the curriculum and textbooks, there is a general and non-gradual reference to a group of issues without focusing on specific core concepts/values [57] (*Assassi in the Arabic language* Grade 9 textbook, p. 42). The teacher guides however, highlighted some universal values (*Assassi in the Arabic language*, Grade 9 teacher guides, pp. 10-13; *Morchidi in the Arabic language*, Grade 8 teacher guide, pp. 6-7, p.10). Reviewers noted that textbooks brought values through the contents of the selected texts and that all texts dealt with a specific issue or value more in an implicit than an explicit way. One example is the text and activities found in *Morchidi in the Arabic language*, Grade 7 textbook, (pp. 67-69). The team ultimately noted that universal human values were observed in the teaching and learning materials (*Assassi in the Arabic language*, Grade 9 textbook, p. 52, p.115, p.159) however, there remains room for clarification and improvement in this area to more closely align with best practices.

Outcomes and competencies: The review used the same criteria noted in Q1, including whether outcomes include measurable indicators of what students are expected to demonstrate upon completion of instruction, to assess whether the middle school curriculum fully included outcomes and competencies, an important component of best practice scope and sequence documents. Outcomes-based teaching and learning requires that curriculum designers and instructors work backwards by first defining the outcomes and then creating the content and desired learning objectives will yield those achievement desired outcomes. The team found evidence across all curriculum materials reviewed that the curriculum does include student learning outcomes and competencies, but they were broad and without easy means of measuring student learning. For example, student textbooks and teacher guides link content to learning outcomes in general terms. However, these outcomes do not describe specific changes in student knowledge, skills, and behaviors that are expected to occur as a result of instruction.

Multiple teaching approaches: The review team also found that some (not all) teacher guides provide opportunities for teachers to use multiple approaches and methods of teaching. The notion of differentiating instruction, which often involves teachers modifying teaching strategies, content, assignments, and even the classroom set-up to teach students with varying learning needs, interests, and levels of preparation, has become an accepted concept in education, championed by [58] and is linked to improved student learning and even closing the achievement gap among learners. The review team determined whether instruction was differentiated by using criteria outlined in the Curriculum & Instructional Design rubric (See Standard 5) as well as the Arabic language Curriculum Review Rubric (See Standard IV, Indicators 13-20), which specify the extent to which curriculum materials are user-friendly and that they are designed to help facilitate student learning and enhance teachers' ability to differentiate instruction for students with diverse learning needs.

Applying these criteria, they noted multiple teaching approaches, however, there was an overall lack of differentiated instruction and an absence of activities that targeted students with diverse needs and levels of performance. Textbooks reviewed provided the same activities for all learners without differentiation according to individual differences and levels. For instance, in some teacher guides, teaching reading strategies (Pre-reading—reading--post-reading) is presented as a set of mental and

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[57] Curriculum and school environment directorate. (2009), Educational programs and directives for the Arabic language instruction in middle school. Ministry of national education, vocational training, higher education and scientific research. Kingdom of Morocco. P.5

[58] CAST (2018). Universal Design for Learning Guidelines version 2.2. Retrieved from http://udlguidelines.cast.org
Darling-Hammond, Linda. (2012). Creating a Comprehensive System for Evaluating and Supporting Effective Teaching. Stanford, CA: Stanford Center for Opportunity Policy in Education
Meyer, A., D.H. Rose, and D. Gordon (2014). Universal Design for Learning: Theory and Practice. Wakefield, MA: CAST Professional Publishing.
Tomlinson, C. (2003). Differentiation in Practice: A Resource Guide for Differentiating Curriculum. Alexandria, VA: ASCD.

cognitive processes and techniques that readers use to achieve reading goals. [59] However, the textbooks repeat the same activities and the very same strategies across all reading texts (see for example, *Mounir in Arabic language* Grade 5 textbook are "I train in journalism" (p. 103) and "Communication Media Literature" (p.111).

Gaps

Integrated pedagogical approach: The review team noted a lack of an integrated approach to language teaching particularly as it relates to the integration and the assessment of learning across the four language skills of listening, speaking, reading, and writing. Leading scholars emphasize the importance of an integrated approach. [60] [61] The review rubrics included specific criteria outlined in the Arabic Language Curriculum Review Rubric to determine whether an integrated approach was present in the curricular materials (see Standard VI, Indicators 32-36). The review team found that despite the adoption of the competency-based approach, [62] its translation into textbook activities made each component of teaching and learning Arabic a stand-alone subject linked to its own competency without any links with the rest of the components. For example, in the 8th grade teacher guide "Mourchidi," while there are systematic reading competencies linked to specific reading components, language competencies linked to the language lesson component, and communication and expressive competencies, linked to the expression and writing (p. 26), these competencies are not explicitly linked to learning objectives and achievement outcomes.

Overall, reviewers determined that while listening, speaking, reading, and writing components are well integrated across early grades textbooks and teacher guides, they are not as well integrated in upper and middle grades curriculum materials. Disintegration was especially pronounced in the review of student textbooks such as *Moufid in the Arabic language*, Grade 7 (see pp. 94-97) and to some extent in the Grade 8 teacher guide *Mourchidi*, as was noted in Q1 findings.

Scope and Sequence: While learning outcomes and competencies is noted as an area of fidelity, these were still underdeveloped in the middle school curriculum and reflect only a piece of what is found in best practice scope and sequence documents that clearly articulate what students should know and be able to do at each grade level. Without a scope and sequence, there is a lack of coordination across the curriculum, teacher guides, and textbooks with regard to what skills taught, and how competencies are assessed. The effects of this were evident in the review of most materials, which do not seem to have a comprehensive scope and sequence matrix that clearly delineates what students are expected to know, be able to do, and how by each grade level. The absence of such a matrix also makes it difficult to determine curriculum alignment horizontally within grades and vertically across grades.

Coordination of concepts and content: Effective literacy curricula include coordinated concepts and values across the grades as well as high quality content in texts used. Specifically, experts note that textbooks should focus on qualitative content (over quantitative), be current and meet the needs and

[59] Curriculum directorate. (2020). Innovations of the primary school curriculum for the school year 2020-2021. Ministry of National Education, Vocational Training, Higher Education and Scientific Research. Kingdom of Morocco. P. 92.
[60] Daniels, H., & Zemelman, S. (2004). Subjects matter: Every teacher's guide to Content-Area Reading. Portsmouth, NH: Heinemann.
[61] Donohue, L. (2012). 100 Minutes: Making Every Minute Count in the Literacy Block. Pembroke Publishers.
[62] Curriculum and school environment directorate. (2009), Educational programs and directives for the Arabic language instruction in middle school. Ministry of national education, vocational training, higher education and scientific research. Kingdom of Morocco.

interests of learners.[63] [64] The review team used outcomes gleaned from extensive discussions guided by standards outlined in the Arabic Language Curriculum Review Rubrics to assess if the textbooks and teacher guides demonstrated a coordination of core concepts and values, and inclusion of high-quality texts (See Standard VIII, Indicators 50-57, and Standard I, Indicators, 1-4). Applying these metrics, the review team found a lack of coordination of concepts and values taught across the grades, a lack of high-quality content in texts used, and textbooks that focused more on quantitative than qualitative content. Additionally, most of the content seems outdated and likely unengaging to students. During robust discussions of findings drawn from the review rubrics, reviewers talked passionately about the fact that that some topics used in reading passages do not address contemporary issues, questions, and/or challenges facing today's students, and that activities accompanying those passages do not include interactive activities and experiences that motivate and engage students in learning.

Instructional time and student-led practice: Students learning languages need time to both be instructed in the multiple components of language and literacy as well as opportunities to practice what they are learning. Scholars[65] recommend that teachers organize their instructional time in blocks of 120-150 minutes throughout the week instead of the typical class duration of 45- minutes per day. The review team considered the curricular timetables, using criteria that examined the emphasis put on different components of reading instruction, and the space given to student-led self-practice. This uncovered that insufficient instructional time was devoted to teaching of the key language arts skills; that is, a lack of balance between teaching students about language and giving them opportunities to practice what they learn in meaningful real-world contexts. For instance, curriculum materials reviewed indicate that contents in most textbooks and curriculum guides, for example, *Moufid in the Arabic language* Grade 7 textbook, p. 94-97, are mainly related to the achievement of cognitive competencies with few opportunities for students to apply acquired knowledge.

Technology integration: Well-integrated use of technology by well-trained teachers makes language, literacy, and content learning possible and enjoyable. Scholars and educational innovators such as Milton Chen[66] believe that learning should not be limited by traditional confines and should not be tied to chairs, desks, and textbooks. Examples of successful technology integration includes the use of resources such as computers, mobile devices like smartphones and tablets, digital cameras, social media platforms and networks, software applications the Internet, etc. The review team looked for technology integration by considering insights gleaned from successful technology integration practices, which are also incorporated in the Curriculum Design Rubric (see Standard 5) and the Arabic Language Curriculum Rubric (see Standard VI, Indicator 36). This resulted in finding that a lack of technology use and other related resources to support student learning. Textbooks and teacher guides hardly reference the use of technology resources such as the above.

Assessment: Given the findings conveyed above related to the lack of a scope and sequence document it is unsurprising that assessment practices were weakly represented in the curriculum. In high quality literacy curricula, one would expect to see a systematic process of collecting data about student learning, using information to inform instruction and document progress.[67] This is important because it is otherwise hard to determine the quality of teaching and its impact on student learning. When reviewing the middle school curriculum, reviewers found a lack of systematic process for assessing

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[63] Taha-Thomure, H. (2011). Standards-Based Instruction for Arabic Language. Academia International, Beirut.
[64] Tanner, D. & Tanner, L. (l995). Curriculum development: Theory into practice. Columbus, OH: Prentice Hall Publishers.
[65] Fountas, I.C., & Pinnell, G.S. (2006). Teaching for Comprehending and Fluency, K–8: Thinking, Talking, and Writing about Reading. Portsmouth, NH: Heinemann.
[66] Chen, Milton. (2010). Education Nation: Six Leading Edges of Innovation in Our Schools. Jossey-Bass.
[67] Mokhtari, K., Rosemary, C., & Edwards, P. (2007). Making instructional decisions based on data: What, how, and why. The Reading Teacher, 64 (4), 354-359.

student's literacy needs, and using data obtained, to inform instruction for all students, including those who may need additional assistance. For instance, one would expect to find guidance in teacher guides about how to gather assessment data, how to interpret findings, and how to use lessons learned to improve teaching and learning. Unfortunately, this is not the case across all curriculum materials. A related finding pertains to a lack of a process for assessing and addressing the literacy and learning needs of students with reading and other learning difficulties.

CONCLUSIONS

On the basis of the above findings, reviewers concluded that while the curriculum materials address universal values throughout the three years of middle school, include student learning outcomes and competencies, and provide opportunities for teachers to use multiple approaches and methods of teaching, there are gaps in five areas including: integrated pedagogic approach that includes all four part of literacy learning, scope and sequence, coordination of concepts and values (including content), instructional time and student-led practice, technology, assessment and differentiation. For instance, established evidence-based standards are present in curriculum, but to a lesser extent in teacher guides and even less so in textbooks. The textbooks are also characterized by an absence of links between the four components of the Arabic language (listening, speaking, reading and writing).
In addition, there is evidence across all curriculum materials that there is no systematic process for assessing student's literacy needs and using data obtained to inform instruction for all students and especially for students with specific reading and learning difficulties, which scholars consider essential. [68] The lack of an assessment and instruction process makes it difficult for teachers to design and monitor instruction in ways that allow teachers to effectively address students' individual needs, interests, and learning preferences. [69]

RECOMMENDATIONS

To strengthen the middle school Arabic curriculum, the review team recommends that the Curriculum Directorate incorporate a scope and sequence matrix that specifies what students are expected to know and be able to do along with performance indicators for each grade level. The skills and competencies delineated through the scope and sequence should be systematically addressed in teacher guides and textbooks. Reviewers further recommend the Curriculum Directorate introduce a systematic process for assessing student's literacy needs and using data obtained to inform instruction for all students and especially for students with specific reading and learning difficulties. Findings align with scholars' guidance that such a coordinated assessment and instruction process will help teachers to differentiate instruction so as to effectively address students' individual needs, interests, and learning preferences. [70] Finally, reviewers recommend closely aligning content, skills, and competencies taught to local, national, and international assessments used to determine the degree to which students have attained expected achievement outcomes.

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[68] Allington, R. L. (2011). What really matters for struggling readers: Designing research-based programs. New York: Pearson Education.
Mokhtari, K., Rosemary, C., & Edwards, P. (2007). Making instructional decisions based on data: What, how, and why. The Reading Teacher, 64 (4), 354-359.
Edwards, P.A., Turner, J.D., & Mokhtari, K. (2008). Balancing the assessment of learning and for learning in support of student literacy achievement. The Reading Teacher, 61(8), 682–684.
[69] CAST (2018). Universal Design for Learning Guidelines version 2.2. Retrieved from http://udlguidelines.cast.org
Pratt, D. (1994). Curriculum planning: A handbook for professionals. Toronto, ON: Harcourt Brace.
Pinar, W. F. (2012). What is curriculum theory? New York, NY. Erlbaum.
[70] CAST (2018). Universal Design for Learning Guidelines version 2.2. Retrieved from http://udlguidelines.cast.org
Tomlinson, C. (2003). Differentiation in Practice: A Resource Guide for Differentiating Curriculum. Alexandria, VA: ASCD.
Supreme Council of Education, Training and Scientific Research, 2017

Reviewers' recommendations focus on scope and sequence, assessment issues, and linkages of instructional components. To this end, content should focus more on quality and meet students' needs, interests, and preferences. Content should be diversified, up-to-date, and adequate to students' abilities in each grade. It should focus on universal values, basic questions and human concepts, include interactive activities, and put active learning pedagogy into practice. A standardized instructional model should be adopted in all cycles of education. Enhanced links between the four components of the Arabic language and between the Arabic language and other subjects to allow for more integrated curriculum in the middle school. In sum, theories of language and literacy development and Arabic language arts should be taken into consideration, such as those in the *Innovations* 2020 document should be incorporated at the primary AND middle school levels when designing (and revising) the curriculum content.

QUESTION 4

WHAT ARE THE GAPS, REDUNDANCIES, MISALIGNMENTS, AND/OR INCONSISTENCIES THAT EXIST BETWEEN THE MIDDLE SCHOOL ARABIC CURRICULUM AND MATERIALS AND THE NEW PRIMARY SCHOOL CURRICULUM AND APPROACHES?

FINDINGS

The review team identified that gaps, redundancies, misalignments, and/or inconsistencies exist between the middle school Arabic curriculum and materials and the new primary school curriculum and approaches. The rubrics used by reviewers detected these imbalances, which can be seen in curriculum design and textbooks and associated resources. Several of the concepts below have been discussed above, especially those present in the new primary school curriculum. This section is therefore focused on the impact across grade levels from primary grades through middle school.

Integrated pedagogic approach: The review team found that while the primary school curricula integrate the teaching of all language skills (i.e., listening, speaking, reading, and writing), middle school curricula and instruction focus more on reading and writing rather than listening and speaking skills. With respect to textbooks, reviewers found that across the board, textbook content and activities in the Arabic language curricula for primary and middle school appear to be guided by seemingly different pedagogical principles and approaches. For instance, one such example can be seen in the fifth unit of the Grade 7 *Mokhtar Arabic language* textbook, p. 41, where the review team found evidence of teaching of reading and writing skills but far fewer opportunities for students to communicate their thoughts and feelings by listening to and talking with one another.

Reading comprehension skills and strategies: The review team also found that while the primary school curricula integrate specific reading comprehensions skills and, to some extent, reading strategies, the review team posits that the middle school curricula offers few skills because of instructional time constraints and/or teacher knowledge relative to teaching reading comprehension skills and strategies. There are very fine and important distinctions between reading skills and reading strategies. Afflerbach, Pearson, & Paris [71] clarify the fine distinctions that exist between reading skills and reading strategies (elaborated in Q1 findings), thus lessening the underlying confusion about how these important concepts are used among literacy researchers and practitioners.

[71] Afflerbach, P., Pearson, P.D., & Paris, S. (2008). Clarifying differences between reading skills and reading strategies. The Reading Teacher, 61(5), 364-373.

The review team assessed whether reading skills and strategies were incorporated across the curriculum by using insights from research and best practices with respect to teaching students to read and understand what they read. These insights are incorporated in the Curriculum Design Rubric (See Standard 2) and the Arabic Language Curriculum Review Rubric (See Standard VIII, Indicators 50-57). This produced examples of where skills and strategies were under-utilized, including across the three years of middle school, in resources such as *Assassi in Arabic language* Grade 9 teacher guide, pp. 58-59,pp. 91-93.

Coordination of concepts and content: The reviewer team noted that language instruction in the middle school curricula focuses on teaching students more about how language works than on how to use language to read, write, and learn across the curriculum. This can be seen in textbooks and teacher guides. On various occasions, the reviewer team noted a lack of sufficient and adequate educational opportunities to enable students to practice and master the skills and competencies taught. For instance, there is a lack of balance between teaching students about language and giving them opportunities to practice what they learn in meaningful real-world contexts. The review team noted a lack of activities that help learners to acquire and practice skills. Indeed, teaching students to connect theory and practice requires helping them to break through theoretical and personal boundaries, which can cultivate their natural curiosity and spontaneity. This includes creating activities that help promote student reflection and engagement in learning—activities that ask them to self-assess, analyze, and reflect on the nature of their knowledge and experiences.

Scope and sequence: Finally, reviewers found that textbook content and activities in the Arabic language curriculum for primary and middle school do not show a clear and organized developmental scope and sequence from grade to grade that delineates learning experiences based on developmental progressions and how children learn. The importance of a scope and sequence has been elaborated on above.

CONCLUSIONS

On the basis of the above findings, reviewers concluded that the Arabic language curriculum and associated materials for primary and middle school need improvement in aligning content, instruction, and student achievement outcomes across the grades. They further noted that the Arabic language curricula for primary and middle school do not reflect a healthy balance (or integration) between content and skills or knowledge and application—i.e., teaching students about language and giving them the opportunity to apply what they learn through meaningful instructional activities and experiences. The materials also do not integrate listening and speaking skills into reading and writing instruction so as to provide opportunities for students to improve oral communication skills and content learning. Finally, the Arabic language curricula for primary and middle school do not adequately incorporate the teaching of language skills and subject matter, nor is it properly aligned with assessments.

RECOMMENDATIONS

To strengthen the revised primary school Arabic curriculum, reviewers recommend the Curriculum Directorate adopt an evidence-based curriculum design framework to help ensure that curricula are well-conceived, and that instruction and assessment of achievement outcomes are informed by international best practices, and that curricula and instruction are coordinated within grades and aligned across primary and middle school grades. They further recommend using a developmental curriculum scope and sequence from grade to grade that delineates learning student outcomes based on developmental progressions and how children learn across the Arabic language curriculum for primary and middle school so as to support students at various levels of learning and development. In addition, reviewers recommend ensuring that the Arabic language curricula for primary and middle school include instruction focused on helping students develop awareness of and use of specific reading comprehension skills and strategies so as to help ensure that students can read and understand what they read. [72]

GENERAL ACTIONABLE RECOMMENDATIONS

In light of the Ministry of Education's vision to set high expectations for all students and to provide them with opportunities to develop reading and writing skills that will enable them to be successful in school from the start, the review team recommends that the Ministry **appoint a special Literacy Curriculum and Instruction Commission to guide the revision and implementation of an evidence-based Arabic Language and Literacy Curriculum across grades one through nine.**

The review team further recommends that the special **commission appointees** consist of school system and school leaders, teacher educators, and parents. The team strongly recommends that the five curriculum reviewers, who helped lead the review of the existing Arabic Language and Literacy Curriculum be appointed to the commission. Their knowledge, skills, and experiences related to curriculum design and evaluation will be essential for improving the Arabic literacy curriculum and in implementing it in schools. Other commission members could include representatives from higher education and other educational organizations or agencies as the MOE sees fit.

Top priorities for the **Literacy Curriculum and Instruction Commission**:

I. **Develop a Scope and Sequence.** Create a developmental scope and sequence framework that specifies what students are expected to know and be able to do along with performance indicators for each grade level.
    a. Delineates learning experiences based on developmental progressions and how children learn across the Arabic language curriculum for primary and middle school.
    b. Provides learning experiences specifically designed to support students at various levels of learning and development.
    c. Demonstrates coherent and methodological progress and development of each component of Arabic language, the skills to be taught and competencies to be attained.
    d. Meets the requirements of international assessments for each grade.

II. **Establish a set of universal themes and concepts.** Incorporate in the curriculum a set of universal themes, universal values, basic questions and human concepts, as ways of connecting ideas and concepts across the disciplines and grades. Content should include interactive activities and be diversified, up-to-date, and be adequate to students' abilities, interests, and preferences in each grade.

III. **Adopt and maintain a curriculum design framework.** Adopt an evidence-based curriculum design framework to help ensure that curricula are well-conceived, and that instruction and assessment of achievement outcomes are informed by international best practices, and that curricula and instruction are coordinated within grades and aligned across primary and middle school grades.

IV. **Institutionalized accommodations and assessments systems for all learners.** Set up an adequate evaluation and support system that is based on clear standards and performance indicators that show the progress to the learning goals and the students' acquisition of skills. This system should include assessment grids for teachers' use but also concrete examples of support for students with learning difficulties, including one-on-one and small-group instructional intervention, and opportunities for enrichment for those that meet or exceed these standards.

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[72] Mokhtari, K., (Ed.,). (2016). Improving reading comprehension through metacognitive reading instruction. Lanham, MD: Rowman & Littlefield.
RAND Reading Study Group. (2002). Reading for understanding: Toward an R&D program in reading comprehension. Santa Monica, CA.

The review team believes that while curriculum change is necessary, curriculum revisions alone will not measurably improve student achievement outcomes. Therefore, the team encourages members of the commission to **establish goals for enhancing the Arabic curriculum that go beyond curriculum enhancements. Goals should concurrently take into account teaching and learning.** The commission is likely to achieve the Ministry's vision of high literacy achievement expectations for all students when setting goals that help ensure that every teacher has access to a high-quality curriculum to teach students the foundations of reading, and language, and literacy, that every student who struggles to read receives research-based literacy interventions, that every school has a culture in which all teachers are responsible for and equipped to deliver effective literacy instruction, that every educator preparation program prepares prospective teachers to use evidence-based literacy practices, that every school system implements a comprehensive literacy assessment plan that includes different assessment tools used for different purposes at different times during the school year, and that every school community expands opportunities for parents and families to be engaged in their children's literacy development.

Given past experience with literacy curriculum and instruction design, implementation, and evaluation, **the commission should be actionable within the next three to six** months in order to begin strategically enacting the above recommendations.

TASK 1B – STEM ALIGNMENT

ALIGNMENT OF MIDDLE SCHOOL MATH, SCIENCE & TECHNOLOGY CURRICULA WITH THE NEW PRIMARY SCHOOL CURRICULA & INTERNATIONAL BEST PRACTICES INCLUDING INTEGRATED STEM APPROACHES

BACKGROUND & SITUATION OF STEM SUBJECTS IN MOROCCO

Math Curriculum. The new progression of curriculum development and reform for mathematics at the primary level (grades 1-6), subscribes to a constructivist spiral approach that builds on students' prior knowledge and promotes problem solving and student-centered learning. The spiral approach also supports the development of students' personal competencies - by means of building up their knowledge, skills, attitudes, and values in a gradual and integrated way. As a competency-based curriculum, the new primary curriculum refers to two sets of standards: Curriculum Standards and Performance Standards. The Curriculum Standards are focused on four major content domains, including numbers and computations, measurement, geometry, and data representation and interpretation. The Performance Standards are structured around eight major processes and proficiencies that describe expertise expected from students to ensure mastery of the content: 1) Make sense of problems and persevere in solving them, 2) Transition from the concrete to the abstract, 3) Use mathematics discourse fluently, 4) Utilize drill and practice to ensure mastery of computations, 5) Focus on mental arithmetic to achieve automaticity, 6) Employ digital and physical tools to support instruction, 7) Model with mathematics, and 8) Incorporate error analysis to reinforce learning of concepts.

The math curriculum at the middle level (grades 7-9) is presented in conjunction with the secondary level (grades 10-12) and targets four major content strands: Number Concepts, Measurement, Geometry, and Data Organization and Numerical Functions. The middle and secondary curriculum highlights a further seven competencies that guide the teaching of math content: 1) Develop positive dispositions and values toward math to enhance interest and motivation in learning, 2) Enhance problem solving capabilities, 3) Strengthen communication skills, 4) Reason quantitatively and abstractly, 5) Make connections with math, 6) Apply math to real life situations, and 7) Employ information and communication technologies to advance new knowledge and skills. The MOE is in the process of undergoing revisions to the middle level curriculum to ensure continuity and coherence with the new primary math curriculum.

Enacting a vision of math curriculum reform in Morocco is timely. However, the rising bar of success in vital subjects such as math puts even greater pressure on the education system to secure strong foundations. Morocco participated in the 2019 Trends in International Mathematics and Science Study (TIMSS). Overall, results in math at Grade 4 and Grade 8 paint a dismal picture as Morocco ranked fifth lowest out of 48 countries for Grade 4 and last out of 40 countries for Grade 8. However, these results were not seen as alarming by MOE reviewers considering the that the TIMSS assessment was conducted before curriculum reform efforts in Morocco took effect at the primary level.

Science and Technology Curriculum. Similar to the math curriculum, recent progression of the science curriculum development and reform at the primary level (grades 1-6) is rooted in a constructivist inquiry-based student-centered learning model, is woven around TIMSS standards, and respects the three cognitive domains (knowing, applying, and reasoning). It encompasses the range of cognitive processes involved in learning science concepts and applying these concepts and reasoning in an integrated fashion. Curricula also address skills pertaining to daily life and school studies that students use in a systematic way to conduct scientific inquiry and investigation and that are fundamental to all science disciplines.

The curriculum includes a technology component that aims to provide opportunities for students to demonstrate understanding of science concepts through the creation of products or the development of projects. While the MOE is proud about this achievement, they are interested in analyzing the degree to which those new curricula are aligned with international best practices, and not only TIMSS.

At the middle school level, science and technology curricula are taught as separate entities. These curricula have not been reviewed, nor updated, since approximately ten years ago. The science curriculum includes life sciences and physical sciences. The MOE plans to revise these curricula imminently, and hence, are interested in capturing the degree to which they are aligned with the newly launched primary school science curriculum. According to the MOE, the technology curriculum subscribes to a product-based curriculum rooted in solving relevant problems within a variety of contexts, considering students' own and others' needs, wants, and values. However, there are concerns pertaining to the degree technology is integrated with sciences at the middle school level, and also the progression of technology from elementary to middle school.

The MOE is extending math and science learning attainment and offerings at the middle school level to ensure continuous, non-disrupted learning as students advance through the educational system. Thus, this is a timely examination of the existing curricula in terms of structure and coherence, alignment with international best practices, and the degree such curricula set the stage for integrated STEM.

GOAL OF THE 2020 CCA STEM REVIEW

Given the above conditions, the goal of CCA Task Team 1b (STEM) was to help build MOE staff capacity to use evidence-based teaching and learning practices to help ensure that primary and middle school math, science and technology curricula align with international best practices and STEM approaches, and to identify gaps across grade levels that are repetitive or misaligned. Specifically, the objectives are to:

a. Review the math, science and technology curricula for adherence to best practice guidance on teaching and learning of these subjects for all learners at the primary and middle school levels.
b. Understand the progression and structure of learning across grades 1-9, in order to identify any gaps in the curriculum that hinder the logical flow across grade levels.

c. Investigate the degree to which math, science and technology curricula pave the way towards integrated STEM approaches.

Task 1b will ultimately conclude with recommendations on how best to **align** the **middle school math, science & technology** curricula with the **primary school** curriculum, to **improve** the curriculum across the **primary and middle** school grades; and to suggest a road map for bringing primary and middle school curricula closer to integrated STEM approaches.

GUIDING QUESTIONS

The following guiding questions are a starting point to structure the review process and as a basis for discussion with USAID and the MOE:

Q1- To what extent are the science and math primary school curricula aligned with international best practices?

Q2- To what extent are the science, technology and math middle school curricula aligned with international best practices?

Q3- To what extent are the middle school science, technology and math curricula aligned with the new primary school curricula?

Q4- In what ways are the current science & math curricula compliant with integrated STEM approaches in the primary school?

Q5- In what ways are the current science, technology & math curricula compliant with integrated STEM approaches in the middle school?

CURRICULUM REVIEW DESIGN AND METHODS

The curriculum review methods undertaken were data-driven, comprehensive, and collaborative with the MOE. The review was designed to capture the various elements that contribute to STEM learning, given that Morocco adopts teaching science, math and technology as separate disciplines. So, while the purpose was to provide recommendations per STEM subjects, the aim was also to provide the MOE a roadmap towards integrated STEM approaches.
Task team 1b kicked off with a desk review on international best practices of curricular offerings in math, science, technology, and integrated STEM approaches. This review was used to develop draft rubrics for each subject and one for STEM integration. During subsequent training workshops, the rubrics were validated with the local teams of experts. These expert MOE participant/reviewers partook in formal training sessions over the course of 10 sessions, each being 2.5-3 hours, and stretching over 3 weeks. The training included discussion and debate, culminating in a common understanding pertaining to the elements, types and purposes of the curriculum. In addition, the team was exposed to the curriculum review approach, the guiding questions underlying it, and had ample time to revise, edit, amend and contextualize the review tools (rubrics) to the Moroccan educational context. The discourse during this phase supported the capacity building of the team and ensured common ground for the actual review process.

Following the training workshops, three teams of MOE participant/reviewers were established to undertake a participatory guided review that evaluated the curricula in each subject area and for STEM overall. A selective sample of the learning materials (Curriculum Document, student textbooks, teacher guides, online teacher resources,[73] etc.), at the primary and middle levels was reviewed to determine degree of alignment with best-practice international frameworks. One team (of three) focused on the math curricula. A second team (of five) was delegated to review the science and technology subjects. The science & technology team was split into three sub-teams: elementary school science & technology sub-team, middle school science sub-team and middle school technology sub-team. The third team, which included all eight reviewers, participated in the STEM integration review with two sub-teams: math and STEM; and, science and technology & STEM. The three teams, and respective sub-teams, worked both separately and collaboratively to ensure sensitivity to the particularity of separate curricula, yet at the same time endeavored to conduct a comprehensive view of the curricula altogether.

Team members worked diligently within a participatory framework to carry out the curriculum review, which lasted eight weeks. During the review each of the three teams met altogether weekly, for two hours each session, to share findings and receive feedback; as well as to make adjustments to plans as was deemed necessary. Sub-groups worked interdependently and cross-checked each other's work to ensure the validity and reliability of findings.

Finally, the teams collaboratively analyzed and reported findings, conclusions, and recommendations in response to each of the guiding questions. The final product was a synthesis of all team members' efforts and was proudly and confidently endorsed by each and every team member. The final Arabic version of the FCR matrices were translated to English, proofread and edited by the lead experts, and are detailed below.

SCIENCE & TECHNOLOGY

The curriculum review approach for both science and technology was inquiry-based and evidence-informed. The review team analyzed various aspects of the curriculum seeking evidence that complied with best international practices, as well as findings that negated or conflicted best practice. To achieve this, it was essential to ensure that all team members endorsed the same conceptual understanding of international best practices, and the corresponding educational terms associated with these. In this line, collaborative discussions and debating during the training workshops played a critical role in arriving at a shared understanding of "quality curriculum." Alignment across the curriculum was assessed with scope and sequence documents developed by the team. Details about these tools and other review rubrics are in the subsequent section on tools and review rubrics.

Alignment with International Best Practice

The underpinning descriptors of quality science curriculum, according to international best practices, highlight elements around six standards: (1) science as inquiry, (2) science & technology, (3) science in social and personal perspective, (4) history & nature of science, (5) science content, and (6) student assessment in science. On the other hand, the descriptors of the quality technology curriculum include seven standards: (1) research competencies, (2) data analysis & planning, (3) technical skills, (4) technical principles, (5) links to math, (6) links to science, and (7) reflective practice. The shared perception of the research-based quality curriculum served as the foundation for the subsequent amendments of the curriculum review tools.

The science review was based on a vast literature, with the Trends in International Mathematics and Science Study -TIMSS (2019) science assessment framework topping the list. Other references that were used to reinforce the conceptual background of the review tools included: The United Nations Educational, Scientific and Cultural Organization-UNESCO's (2016) recommendations of what makes a quality curriculum; the Organization for Economic Cooperation and Development- OECD's (2018)

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[73] MOE. Online Teacher guides for grades 1-6.

recommendations pertaining to best practices of learning and teaching science; and the National Science Education Standards of the US- NSES (2017) science education standards. TIMSS (2019) three cognitive domains: knowing, applying and reasoning constituted the foundation for the review tool around life, earth, and physical sciences.

At the level of knowledge, the review was intended to assess the degree students were given the opportunities to:

(1) identify or state facts, relationships, and concepts; identify the characteristics or properties of specific organisms, materials, and processes; identify the appropriate uses for scientific equipment and procedures; and recognize and use scientific vocabulary, symbols, abbreviations, units, and scales.
(2) describe or identify descriptions of properties, structures, and functions of organisms and materials, and relationships among organisms, materials, and processes and phenomena.
(3) provide or identify examples of organisms, materials, and processes that possess certain specified characteristics; and clarify statements of facts or concepts with appropriate examples.

At the level of applying, the review attempted to assess the degree students were given the chance to:

(1) identify or describe similarities and differences between groups of organisms, materials, or processes; and distinguish, classify, or sort individual objects, materials, organisms, and processes based on characteristics and properties.
(2) relate knowledge of an underlying science concept to an observed or inferred property, behavior, or use of objects, organisms, or materials.
(3) use a diagram or other model to demonstrate knowledge of science concepts, to illustrate a process, cycle, relationship, or system, or to find solutions to science problems.
(4) use knowledge of science concepts to interpret relevant textual, tabular, pictorial, and graphical information.
(5) Provide or identify an explanation for an observation or a natural phenomenon using a science concept or principle.

At the level of reasoning, the review investigated opportunities made available for students to:

(1) Identify the elements of a scientific problem and use relevant information, concepts, relationships, and data patterns to answer questions and solve problems.
(2) Answer questions that require consideration of a number of different factors or related concepts.
(3) Formulate questions that can be answered by investigation and predict results of an investigation given information about the design; formulate testable assumptions based on conceptual understanding and knowledge from experience, observation, and/or analysis of scientific information; and use evidence and conceptual understanding to make predictions about the effects of changes in biological or physical conditions.
(4) Plan investigations or procedures appropriate for answering scientific questions or testing hypotheses; and describe or recognize the characteristics of well-designed investigations in terms of variables to be measured and controlled and cause-and-effect relationships.
(5) Evaluate alternative explanations; weigh advantages and disadvantages to make decisions about alternative processes and materials; and evaluate results of investigations with respect to sufficiency of data to support conclusions.
(6) Make valid inferences on the basis of observations, evidence, and/or understanding of science concepts; and draw appropriate conclusions that address questions or hypotheses, and demonstrate understanding of cause and effect.
(7) Make general conclusions that go beyond the experimental or given conditions; apply conclusions to new situations.

(8) Use evidence and science understanding to support the reasonableness of explanations, solutions to problems, and conclusions from investigations.

Finally, science inquiry constituted the overarching science practice that was assessed specific to both content and thinking processes outlined above. The tool assessed whether students were given opportunities to: (1) ask questions based on observations, (2) generate evidence, (3) work with data, (4) answer the research question, and (5) make an argument from evidence.

Technology

As for technology, the curriculum review tool was similarly based on a vast literature, with GSCE standards of the UK Government [74] topping the list. Besides this, Guzey & Moore (2017) was used to reinforce the conceptual background of the tool with its STEM framework. The tool is built around core knowledge, understanding and skills that are required in the technology curriculum to enable students to apply iterative design processes through which they explore, create and evaluate a range of outcomes. The tool aims to assess, as per international practice, the degree students are provided with ample opportunities to solve real and relevant problems, considering their own and others' needs, wants and values. The tool also investigates the degree to which the current curriculum invites students to apply knowledge from other disciplines, including mathematics, science, art, computing and the humanities.

Moreover, the technology curriculum review tool aimed to assess whether learning opportunities offered to students were presented as context dependent. In other words, it checks whether the curriculum utilizes potential contextual challenges to guide students in their explorations and clarifications of design problems and opportunities, leading to the development of their own design briefs, which would inform and direct their designing and making. The tool also explored the degree to which students were assessed on their abilities to analyze and respond to contexts, rather than their knowledge of specific contextual areas. Examples of contextual challenges include: extending human capacity, responding to the unexpected, improving living and working spaces (environments and objects), securing a sustainable future, protecting people and products, promoting health and wellbeing, developing and communicating personal, social, and corporate identity, and developing communities.

MATH

The review of the primary and middle school curriculum in math adopted a content analysis approach to examine the alignment between the Moroccan curriculum and its supporting resources (student textbooks, teacher manuals, etc.) with international best practice pedagogical models for math. Content analysis employed Webb tool, [75] which uses expert raters (MOE reviewers) to code content across several domains. The curriculum review process targeted two analyses: 1) the degree to which primary and middle level curricula are aligned with international best practices, 2) the extent of curriculum continuity between primary and middle schools.

Alignment with International Best Practice

To conduct a review of the degree to which the primary and middle level math curricula adhere to international best practices (Q1& Q2), the review drew on three best practice models to create review

[74] www.gov.uk/government/publications

[75] Webb, N. (2002). *Alignment study in language arts, mathematics, science, and social studies of state standards and assessments for four states: A study of the State Collaborative on Assessment & Student Standards (SCASS), Technical Issues in Large-Scale Assessment (TILSA)*. Washington, DC: Council of Chief State School Officers.

rubrics: TIMSS 2019 [76] Math Framework, UNESCO 2018 Global Content Reference Framework for Math (GCR), [77] and PISA 2021 Mathematics Framework. [78] The 2019 math TIMSS assessment framework is organized around two dimensions: content dimension, specifying the subject matter to be assessed; and cognitive dimension, specifying the thinking processes to be assessed.
More concretely, the review of the primary and middle levels targeted the examination of major shifts in curriculum and learning material regarding:

1. Content: from a theoretical teaching of the subject to a variety of contexts that generate learning with understanding.
2. Expectations from students: from merely applying algorithms to using problem solving strategies.
3. Learning: from memorization and repetition to exploration and investigation, self-discovery, and creativity.
4. Teacher's role: from an information provider to an organizer of a wide variety of learning activities for all students, adapted to individual levels of attainment and inclusive of all levels of development.
5. Assessment: from the rigidity of marks/points meant to classify students to self-assessment and progress assessment.

The review assessed whether the curriculum is set up to meet these targets, although the ultimate implementation of the curricula following these objectives was beyond the scope of the CCA.

Degree of Continuity between Primary and Middle Schools

The review also examined the degree of continuity between primary and middle level math curricula and learning materials (RQ3). Besides the Math rubric, scope and sequence matrices were built by participants during and post training. A close examination of the scope and sequence charts enabled the team to determine whether the progression of learning standards was appropriately aligned across grade levels.

Alignment indices were calculated as the proportion of content in cell-by-cell agreement between two content analyses using Porter (2002) [79] alignment formula:

$$\text{Alignment} = 1 - \Sigma_i |x_i - y_i| / 2$$

The x_i represents the proportion of document x (e.g., Moroccan standards, textbook, manuals, etc.) in cell i of the Moroccan curriculum, and the y_i represents the proportion of document y (e.g. the best practice standards) in that cell. Alignment index is calculated as one minus half the sum of the absolute values of the discrepancy between the ratios x_i and y_i. The calculated Porter alignment index ranges from 0 to 1 with 0.5 as its center since it uses absolute differences, a characteristic the math reviewers took into account when interpreting the computed values. The extent of alignment was then examined as a proportion ranging from 0 (no alignment) to 1 (perfect alignment). Using Porter index, a number of indices were generated that indicated the degree of alignment between the Moroccan curriculum and best practice models at the content and cognitive levels. To ascertain the strength of alignment, the review team adopted the critical values metric [80] where indices less than 0.40 are rated very weak,

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[76] Mullis, I. V. S., & Martin, M. O. (Eds.). (2017). *TIMSS 2019 Assessment Frameworks*. Retrieved from Boston College, TIMSS & PIRLS International Study Center website: http://timssandpirls.bc.edu/timss2019/

[77] UNESCO UIS (2018). Math Content Reference Framework. UNESCO, Paris.

[78] OECD(2018). PISA 2021 Mathematics Framework.

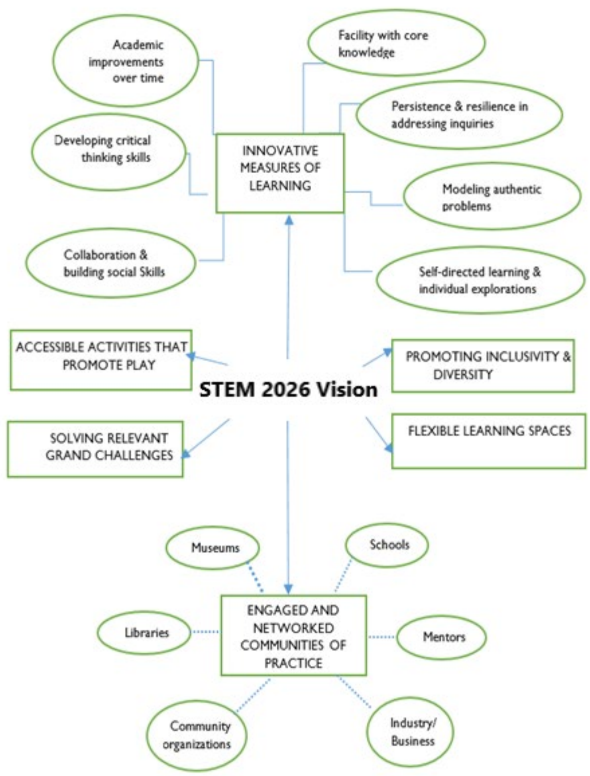
[79] Porter, A. C. (2002). Measuring the content of instruction: Uses in research and practice. *Educational Researcher, 31*(7), 3-14.

[80] Fulmer, G.W. (2011). Estimating critical values for strength of alignment among curriculum, assessments and instruction. *Journal of Educational and Behavioral Statistics, 36*(3), 381−402. http://dx.doi.org/10.3102/1076998610381397

between 0.41 and 0.69 as weak to moderate, between 0.70 and 0.89 as moderate to high, and more than 0.90 as very high.

STEM INTEGRATION

The review of the new primary and existing middle school curriculum in math, sciences, and technology emphasized the need to train students to face the challenges of technological development. The process drew upon the tenets of competency- and value-based approaches, as well as best practices in innovative pedagogical integrated STEM models. As such, the curriculum review design subscribes to three best practice integrated STEM models: The conceptual framework for integrated STEM education,[81] The Engineering Design-Based STEM Integration Curriculum Assessment (ICA),[82] and STEM 2026 Vision[83] that helped build a stronger evidence base for the types of STEM teaching and learning experiences that work best in particular contexts to serve diverse learners. The adopted STEM 2026[84] Vision focuses on six interconnected components: four key Vision statements that are then linked to “engaged and networked communities of practice” and “innovative measures of learning,” each of which have a series of sub-components – (see Figure X). The two research-based conceptual frameworks examine the quality of integrated STEM curricula and delineate major dimensions and indicators combined into several categories to assess quality of STEM integration in the curriculum.



81 Kelley, T. & Knowles, J. (2016). A conceptual framework for integrated STEM education. International Journal of STEM Education,3-11.

82 Walker, W., Moore, T., Guzey, S., Sorge, B. (2018). Frameworks to develop integrated STEM curricula. *K-12 STEM Education, 4*(2), 331-339.

83 US Department of Education (2016). STEM 2026: A vision for innovation in STEM Education. Office of Innovation and Improvement.

84 US Department of Education (2016). STEM 2026: A vision for innovation in STEM Education. Office of Innovation and Improvement.

The STEM curriculum review focused on identifying potential gaps, inconsistencies, or disparities preventing a best-practice STEM integrated approach from being realized at the primary and middle levels (RQ4 & 5). Two tools were employed to conduct the STEM analyses, 1) a generic integrated STEM checklist and 2) scope and sequence matrices of math, science, and technology content at the primary and middle levels. During the training workshops all eight MOE reviewers examined theoretical, epistemological, and research-based evidence related to STEM integration and received focused remote training on implementing the rubrics in the review and analysis process.

REVIEW TOOLS AND RUBRICS

The starting point for the development of the tools was agreeing on the guiding questions for the curriculum review tools with the MOE. Phrasing the guiding questions, with greatest possible accuracy in a fashion that closely matches what the stakeholder are keen to know, follows a recommendation from international practice of curriculum reviews (Cockell & McArthur-Blair, 2012). The draft rubrics were based on the international definition of curriculum such as that of Lattuca & Shark (2009), who define the curriculum an "academic plan," that includes: the purpose of the curriculum (i.e., goals for student learning), content, sequence (the order of the learning experience), instructional methods, instructional resources, evaluation approaches, and how adjustments to the plan would be made based on experience or assessment data.

As stated earlier, rubrics were revised, edited, amended and contextualize to fit the Moroccan educational context. In addition, because the scope and sequence for all the concerned curricula did not exist, the team worked in collaboration with the consultants on producing such matrices which were essential for carrying out the review using the rubrics. Finally, the team synthesized their findings, conclusions and recommendations (FCR) into one matrix. The FCR matrix constituted the basis for this final report and required reviewers to analyze and prioritize from the huge amount of data they collected using the rubrics and the scope and sequence matrices.

SCIENCE & TECHNOLOGY

The science & technology curriculum review was facilitated by the tools listed and described in the following table:

Tool	Purpose	Interpretation
Scope & sequence (SS) 1) Elementary Science 2) Middle School Science-Life & Earth 3) Middle School Science – Physical Science 4) Middle School Technology	SS ensured that the interrelated concepts that refer to the overall organization of the curriculum were presented in an order that helped ensure coherence and continuity. Scope refers to the breadth and depth of content and skills to be covered. Sequence refers to how these skills and content are ordered and presented to learners over time.	This tool helped reviewers visually capture continuity of the curriculum within the grade level and its presentation across grade levels.
Curriculum review rubric 1) Elementary Science 2) Middle School Science-Life & Earth	The curriculum review rubric helped reviewers remain focused whilst collecting data pertaining to the curriculum review guiding questions.	Each standard consisted of a set of indicators, each of which were scored with a maximum of 4 points (based on a 4-point Likert scale). For a given

3) Middle School Science – Physical Science 4) Middle School – Technology	Brought together a set of statements under each of the 6 standards in science and 7 standards in technology. Furthermore, the curriculum review rubric guided reviewers to collect data systematically from 3 curriculum resources (Curriculum Directives, teachers' guide books, & student text books).	number y of indicators, the score (S) on this standard is the (S)/(4*3*y); 4*3*y being the maximum score for that standard. As such, the percentage per standard can be calculate using the formula: % = (S) * 100 /(4*3*y). The closer the percentage was to 100%, the closely the curriculum showed compliance with international best practices.
FCR – Science & Technology	The purpose of the FCR matrix is to provide data-driven recommendations for the stakeholders pertaining to the revised curricula.	The FCR brought together all the data collected, by all data collection tools, in the form of responses to guiding questions. Besides reporting the findings, the FCR synthesis conclusions and provides recommendations for concerned parties.

MATH

Two tools were refined during the workshops and then employed to conduct the math analyses, 1) Math rubric and 2) scope and sequence matrices of math at the primary and middle levels. As noted for science and technology subjects, the scope and sequence matrix for math was similarly developed by the review team in order to appropriately execute the Math Rubric fully, i.e. to assess criteria related to the content and progression of learning in the math curriculum. The Math Rubric was developed to gather detailed information about the degree to which the curriculum and materials align with best practice math standards. It comprises three components: component 1 focuses on mathematics content trajectories; [85] component 2 focuses on mathematical practices and underlying cognitive domains; [86] and component 3 focuses on important considerations complimentary to the standards, like assessment and integrated technology, that can impact implementation of mathematics curriculum. [87] Due to discrepancies in content specifications across grade levels, component 1 was considered separately for primary and middle levels. However, components 2 & 3 were generalized for both levels. All three components provide different lenses on which to base a comprehensive analysis and ultimately an informed decision. Porter Index [88] was employed to discern the strength of alignment for Components 1 & 2. To review Component 3, reviewers used percentages of occurrence and critical values metric: [89]

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[85] Mullis, I. V. S., & Martin, M. O. (Eds.). (2017). *TIMSS 2019 Assessment Frameworks*. Retrieved from Boston College, TIMSS & PIRLS International Study Center website: http://timssandpirls.bc.edu/timss2019/

[86] Mullis, I. V. S., & Martin, M. O. (Eds.). (2017). *TIMSS 2019 Assessment Frameworks*. Retrieved from Boston College, TIMSS & PIRLS International Study Center website: http://timssandpirls.bc.edu/timss2019/

[87] OECD (2018). PISA 2021 Mathematics Framework

[88] Porter, A. C. (2002). Measuring the content of instruction: Uses in research and practice. *Educational Researcher, 31*(7), 3-14.

[89] Landis, J., & Koch, G. (1977). The measurement of observer agreement for categorical data. *Biometrics, 33*(1), 159-174. doi:10.2307/2529310

percentages less than 40 were rated very weak, between 41% and 68% as weak to moderate, between 70% and 89% as moderate to high, and equal to, or more than 90%, as very high.

Component 1: To help reviewers conduct the analysis, two lenses: **coverage** and **balance**, were used to gather evidence regarding adherence to best practices model (TIMSS 2019 [90], GCR 2018 [91]). **Coverage** reports the extent to which reviewers found the designated mathematics content areas listed. Reviewers had to decide if (1) the mathematics content area was found, (2) major, some, or a few gaps were found, or (3) the mathematics content area was covered fully. Also, coverage included the actual instruction time allotted in the Moroccan curriculum in comparison to the time recommended by the best practice models. **Balance** addressed the degree to which the mathematics content is developed with a balance between mathematical understanding and procedural skill in ways that are consistent with the standards of best practices.

Component 2: To determine the extent to which the curriculum and its materials were designed to provide students with opportunities to acquire pertinent cognitive competencies by engaging in international Standards (TIMSS 2019, GCR 2018) for mathematical practice: reasoning and explaining, modeling and using tools, generalizing and extracting structure, acquiring productive mathematical habits of mind. Additionally, this component described a designated set of cognitive dimensions.
Component 3: Addressed two overarching considerations to alignment with best-practice STEM models: assessment and technology.

Overall, the Math Rubric assessed the extent to which the new primary curriculum and its materials (curriculum directives, student textbooks, and teachers' guides) align with best practice approaches in mathematics. The complete Math Rubric can be found in Annex I**.**

STEM INTEGRATION

To review the extent of STEM integrations across subjects and grade levels, two rubrics were developed: 1) An integrated STEM checklist based on the 2018 ICA framework, and 2) scope and sequence matrices developed during the capacity building workshops.

The *Integrated STEM checklist* assesses STEM quality integration and intensity of agreement on seven major categories: (1) a motivating and engaging context, (2) an engineering design challenge, (3) integration of science content, (4) integration of mathematics content, (5) (student-centered) instructional strategies, (6) teamwork, (7) Information technology and communication. The checklist was employed in two ways, namely, to assess the degree of agreement between math, science, and engineering standards with the STEM ICA framework, therefore discerning the quality of STEM integration in the curricula at the primary and middle levels. The checklist also provided professional development guidelines centered around STEM integration, which assisted MOE reviewers in reflecting on potential means to develop overlapping curricular units across content areas. To discern the strength of agreement, a scale [92] of divisions was adopted as follows: <20% indicated no agreement, a value between 21% and 40% indicated poor agreement, between 41% and 60% as moderate, between 61% and 80% as substantial, and more than 81% as almost perfect.

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[90] Mullis, I. V. S., & Martin, M. O. (Eds.). (2017). *TIMSS 2019 Assessment Frameworks*. Retrieved from Boston College, TIMSS & PIRLS International Study Center website: http://timssandpirls.bc.edu/timss2019/

[91] UNESCO UIS (2018). Math Content Reference Framework. UNESCO, Paris

[92] Landis, J., & Koch, G. (1977). The measurement of observer agreement for categorical data. *Biometrics, 33*(1), 159-174. doi:10.2307/2529310

The generated scope and sequence matrices for primary and middle levels delineated interrelated concepts in math, science, and technology that reflected the breadth over time and depth of content and skills covered by the Moroccan curriculum. Several scope and sequences charts were developed by MOE reviewers during the participatory review stage that showed the progression of content and highlighted potential opportunities for multi-disciplinary integration across subjects.

TASK 1B – STEM ALIGNMENT FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

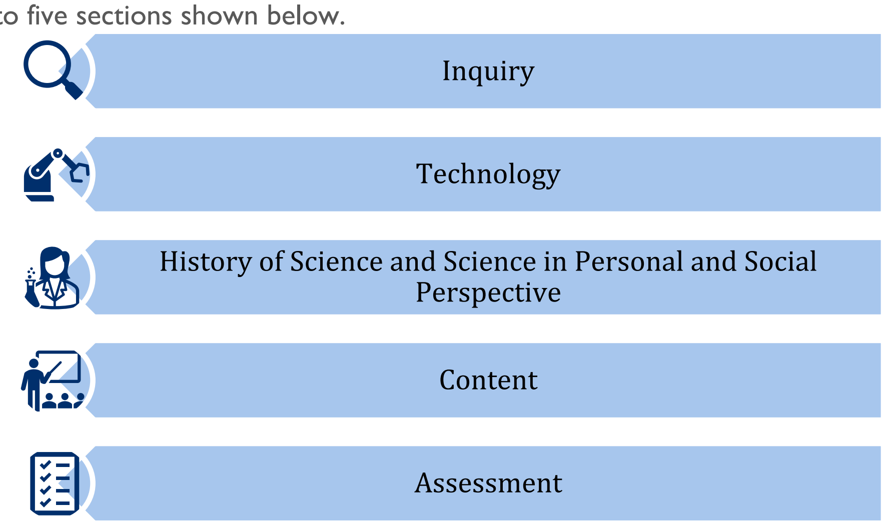
QUESTION 1

TO WHAT EXTENT ARE THE SCIENCE AND MATH PRIMARY SCHOOL CURRICULA ALIGNED WITH INTERNATIONAL BEST PRACTICES?

FINDINGS

This section, as well as the responses to each question, first examines the science curricula, then math curricula at the primary level. While there is no unique technology curriculum at the primary level, the science and technology team did assess technology lessons, where they appeared within the science curriculum. The themes covered in each subject area are introduced at the start of each subject-section.

Science
Overall, the primary school science curriculum showed compliance with international best practice in many of its elements. Using the Science Rubric, the review team analyzed the curriculum document, teachers' guides, and student textbooks of randomly selected book series in full. Findings have been categorized into five sections shown below.



Inquiry. A major area of strength of the primary science curriculum is the adoption of scientific inquiry. In fact, the curriculum directives make a clear statement on adopting science as inquiry: "Inquiry should be adopted in learning and teaching science because it secures the context for students to act out as scientists. This enables them to make observations, pose questions pertaining to such observations, provide possible explanations (hypotheses), design and conduct experiments and investigations to accept or refute these hypotheses, analyze data, arrive at conclusions, and design and build models" (p.258).

However, while teachers' guides were at times compliant with the Curriculum Document in terms of learning and teaching as inquiry, student textbooks seemed to be less acquiescent. Taking the series: "Al-Jadeed Fee Al-Nashat Al Elmee" as an example, there was an absence of any opportunity for students to indulge in scientific investigations, to provide explanations using evidence, and to make inferences in the case of grade 1. Compliance between teachers' guides and the Curriculum Document sometimes failed to demonstrate cohesion. An example from the same series and same grade level showed that the teachers' guide did not direct teachers to make links to mathematics, despite the fact that the Curriculum Document advocated this (p. 286). The same finding was noted in other book series such as "Al Wadeh Fee Al-Nashat Al Elmee" (grade 3), "Al-Munir Fee Al-Nashat Al Elmee" (grades 4), and "Al-Tajdeed Fee Al-Nashat Al Elmee" (grade 6).

While the Curriculum Document provided directions for students to "apply" inquiry while learning science, there was almost no guidance to have them "develop" their own scientific investigations around problems of interest. This element was missing across grade levels of the science primary curriculum.

Technology. The Curriculum Document gave directions towards "involving students in developing projects to leverage their abilities at solving real-life problems, by inviting them to make use of their acquired knowledge and skills in designing and producing in a way that allow them to function as little engineers" (p.259). However, such directions were not cascaded to teachers' guidebooks, nor to students' textbooks. This was evident across grade levels. Yet, this gap between the Curriculum Document, teachers' guides and students' textbooks ceased to exist when it came to opportunities for students to develop their understanding about science and technology; as it turns out to be missing in all the three. In fact, there was no detection of any opportunities for students to understand the relationship between science and technology: Students are not directed to: (1) make a clear cut distinction between scientific inquiry and technological design and their reciprocal relationship; (2) understand that perfectly designed solutions do not exist; (3) realize that technological designs have constraints; nor to (4) comprehend that technological solutions have intended benefits and unintended consequences.

History of Science and Science in Personal & Social Perspective. The Curriculum Document stated that "primary science curricula should secure technology-related projects that brings together all areas of science… to promote their abilities to solve daily-life problems," (p.259). While this was a direction for curricula to endorse a science-technology-approach (STS), teacher guides and student textbooks did not abide by it. Moreover, neither the Curriculum Document, nor teachers' guides or student textbooks directed students to understand that science is a human endeavor. For example, the reviewers did not spot any instance in all three documents where students were guided to understand that science and technology can reasonably contribute to society; or that new technologies often decrease some risks, but they might also increase others.
Additionally, all three documents: Curriculum Document, teacher guides, as well as student textbooks failed to provide opportunities for students to acquire knowledge and appreciative attitudes about the history of science. For example, there were no instances where students could possibly learn that science is cumulative and that the construction of scientific knowledge is impacted by data collection. So, as more data is collected and more discoveries are made, science builds towards a more complete and accurate understanding of the physical universe.

Content. The primary science curriculum showed a relatively strong compliance with international best practices in terms of content. In fact, the content offered closely matches what is prescribed by TIMSS, thus offering students the opportunities to learn in the following content domains: life science, physical sciences, and earth science. However, the scope and sequence documents indicate some gaps regarding the progression of concepts across grade levels. For example, grades 1 and 2 science do not offer any learning opportunities for students in the domains of earth & space science, and completely lack a technology component. Besides this, only two out of three areas of life science, and one out of three areas of physical sciences were addressed in these two grade levels.

Assessment. Data reviewed pertaining to whether the assessment of students in science aligned with international best practice has shown closer matches when it comes to assessment *of* learning, and less compliance with assessment *for* learning, and the least compliance with assessment *as* learning. To start with assessment of learning, the Curriculum Document directed practitioners to assess students at both lower and higher order thinking skills (p. 264). This was well cascaded to both teachers' guides and students' textbooks as per the review of all grade levels of the primary school.

The Curriculum Document then advised on engaging students in performance tasks: "Teachers should use performance tasks to assess students such as hands-on experiments, inquiry logs, projects, direct observations, continuous observations, presentations, research projects, wall newspapers, creating models and posters as well as discussions" (curriculum innovations, p.262). Unfortunately, this direction reached only teachers' guides: it was never identified in any of the reviewed students' textbooks. This same description held in regard to assessment of attitudes (affective domain).

Moreover, communicating success criteria to students was evident in all three documents across grade levels except for grade 1. For example, in grade 3, this direction appeared on p. 262 of the Curriculum Document, p.72 of the teacher's guide and p.22 of student's textbook. Finally, there was no evidence in students' textbooks pertaining to competency-based assessment, although it was well specified in the Curriculum Document as well as in teachers' guides.

As stated earlier, the assessment for learning was less compliant with international best practices. In fact, assessment tasks simulated the lived experiences of students in their daily lives, as per directions offered in both the Curriculum Document and teachers' guides across grade levels. These types of assessment tasks were noted across all documents. However, students were not being assessed using a spectrum of performance tasks as stated earlier, despite the fact that the Curriculum Document advocated it and the teachers' guides mentioned it. Moreover, students did not seem to be given the opportunity to play an active role in their own assessment. As for providing spaces to offer feedback to students, the Curriculum Document and teachers' guides did advocate giving feedback to students and students' textbooks did respond to this - except grade 1 - where it was missing.

Finally, assessment as learning seemed to be missing across grade levels and throughout all curriculum documents.

Math

The Math Review Team conducted an in-depth content analysis to measure the extent of alignment between the math new primary curriculum and international best practice models. The alignment was examined across curriculum standards and supporting materials (Textbooks, Teacher Manuals, etc.) on four dimensions: alignment of time coverage, alignment of competency coverage with respect to the math domains, alignment of cognitive level coverage, and alignment in relation to technology integration and assessment in mathematics.

Alignment of Allotted Time. In terms of alignment of time coverage, the review team found that the allocated instructional time does not allow attainment of the established objectives particularly in the area of data representation and processing. For numbers and operations, geometry and measurement, the reported Porter's indices indicate a medium to high alignment of content coverage compared to data organization and processing which reported a weak to moderate alignment with the recommended time in best practices. This finding was further confirmed by the fact that time allocated for teaching numbers and operations covered 66% of instructional time while the recommended by international best practices is 50%. However, almost 8% of instructional time in the new primary curriculum was allotted to teaching data organization and processing, much less than 20% recommended by best practices.

The alignment indices of competencies with recommended best practices in the domains of numbers and arithmetic, geometry, and measurement ranged from weak to moderate (Porter index=0.61, 0.65, 0.65), with significant variations across the curriculum standards as delineated in the Moroccan curriculum directives, student textbooks, and teachers' guides. For data organization and processing competencies, the alignment was very weak (Porter index=0.38) indicating that there were insufficient data processing opportunities for learners to master the competencies associated with this vital domain, despite its essential role in facilitating the learning of elementary principles of probability that students are expected to learn at middle level.

The weak alignment in geometry and measurement was manifest in several gaps; for example, the limited use of elementary properties of geometric transformations, including linear and rotational symmetry to describe, compare and create common two-dimensional shapes (circles, triangles, quadrilaterals, and other polygons) (*Al Jadeed fi Arryadyaat* grade 6 pp.: 30-31-32-33). Also, the review team detected a limited focus on using diagram models to represent some geometric constructions or relationships (*Same source as previous*, pp: 86-87-88. "Solve the situations of a problem related to the geometric constructions of regular figures and their properties"). Similarly, the measurement domain lacked focus on problem-solving that involves linking some concepts of measurement beyond direct use of basic arithmetic rules in the learner's textbook (*Same source as previous*, pp. 52-53-54-55). Additionally, the learning objectives in the Curriculum Document failed to relate to modeling, compared to activities in the learner's textbook and the teacher's guides (Curriculum Document: p. 197; grade 1, *Fadae Arryadyat* - PP: 10-49; Teacher's Handbook *Fadae Arryadyat* Grade 1 - P: 64 " He observes drawings and connects each group to another.")

Alignment of Content Coverage. The review team determined a weak to moderate alignment of competency coverage in the Curriculum Document (Porter index= 0.68) where significant agreements were detected in terms of emphasis on error-based pedagogy in mathematical activities, the focus on mental arithmetic, etc. However, Moroccan content standards adopted the principle of moving from the concrete to the abstract without emphasizing the need to shift instruction in the opposite direction from the abstract to concrete (the Curriculum Document, p. 195 "The principle of starting from the concrete to the abstract."). There was also little emphasis in the standards on making connections between different mathematical concepts, for example between area, perimeter and volume, as well as diversifying the use of numerical, geometric and modeling representations.

On the other hand, the alignment of the content in learners' textbooks was very weak (Porter index=0.32). This misalignment was evidenced by numerous conceptual errors across topics that could easily result in students developing misconceptions. There was also a lack of activities related to finding the missing number, or the missing operation in a number sentence, and identifying or writing number statements or sentences to represent problem situations that include unknowns (*Fadae Arryaadyaat* grade 3, P. 109. n 5.1). Another example of this is the shortage of activities that enable the learner to perform measurement and estimation, and to use measurement to infer certain characteristics or solving problem situations with practical contexts that use measurement (*Almarjie fi Arryadyaat* Grade 2: P: 33). To illustrate, Activity 10 "Contour the Possible Length," selecting the dog's image and the scale of minimization adopted for the three images was not conducive to reaching the goal of estimating lengths.

Overall, the review team noted poor coverage of content and less emphasis on student-centered individualized learning with varied degrees of complexity.

Similarly, the alignment of the content competencies through the teacher's manual was very weak (Porter index=0.25). This misalignment was manifest in the weak directives that could enable individualization of the learnings, or focus on some of the skill goals associated with the established learning objective (*Al Jayyid fi Arryadyaat* guide, Grade 4, P.200). The reviewed teacher guides for grades 1-6 did not provide clear guidelines, nor support for teachers to facilitate inquiry learning, draw on opportunities provided by appropriate contextual situations, or gain a solid understanding of mathematical concepts to facilitate student learning.

Alignment of Cognitive Levels Coverage. The review team revealed that while there was a strong alignment (Porter index=0.99) on the *knowing* level, between the cognitive levels in the Moroccan curriculum and those recommended in the best practice model, and a moderate to high alignment on the *applying* level (Porter index=0.73), alignment was almost negligible on the *reasoning* level (Porter index=0.29). The weak focus on higher cognitive levels in the curriculum and its resources could be attributed to a strong focus on content and skills that target knowledge and application. It also indicates an emphasis on procedural skills versus building mathematical concepts. Although highlighted in the curriculum document, the transversality of problem-solving did not enable opportunities to explicitly target building skills associated with higher levels of knowledge. The general character of the problem solving process has not bound textbook authors to incorporate higher thinking skills into learning activities in the textbook nor teacher guides.

Alignment of Technology Integration and Assessment in Math. The review team found moderate to high alignment (Porter index=0.83) of integrated technology in mathematics with international best practices in the Curriculum Document. For example, the Curriculum Document referred to the supplementary kit within the framework of the *PEEQ* project (Promoting Education with Equity and Quality project, which was launched in partnership with Japan International Cooperation Agency in 2014) and the resources available on the *tilmidtice* student virtual platform. Additionally, there was explicit direction to adopt pedagogical scenarios aimed at integrating information and communication technologies (Curriculum Document, pp. 196-197), and the use of calculators and coding for teaching mathematics (Curriculum Document P. 197 - Article 6 of the terms of specifications). However, there were no references to forums of experience exchange, discussion, nor webinars.

On the other hand, a weak to moderate alignment of technology integration in mathematics was detected in textbooks (Porter index= 0.68) and teacher's guides (Porter index= 0.60). Reviewers inferred from this finding that despite the availability of real opportunities for technology use in mathematics, the absence or weakness of stating what technology is intended for and the ways it intersects with mathematics made it impossible to tap into available opportunities. For example, in textbooks, few activities aimed at training learners to use non-digital technological tools related to the field of measurement and geometric constructions. Furthermore, teacher guides did not provide extensions, nor references to digital technology use in activities, except for references included in the Curriculum Document. Teacher guides were directed to tools associated with the lessons' activities, but the directions included in the manual failed to provide adequate directions to train learners on the independent use of non-technological tools. Also, teacher guides under review were mostly devoid of any reference to technology-related resources produced by the *PEEQ* project.

In terms of assessment of learning, the review team calculated a moderate to high alignment between best practice models and the curriculum document (Porter index=0.81), and teacher guides (Porter index=0.74), and weak to moderate alignment with textbooks (Porter index= 0.66). For example, the curriculum document provided specifications on preparing a teacher's guide: it listed examples of diagnostic evaluation activities related to the achievements in previous grades, and proposed activities for preventive remedy...(Curriculum Document p: 217, 249). Furthermore, evaluation of learning components in the curriculum document was characterized by generality with no specific guidelines for implementation (terms of specifications, Article 6: Considering error as a part of, and inherent to, the learning process, and the need to take it into account in planning activities).

CONCLUSIONS

Science

The review found that the primary school curriculum showed alignment with international best practices in many areas at the level of the curriculum guide, however, there were also areas that require revisions:

9. Directions of the Curriculum Document were not always accurately and completely cascaded into the teachers' guides.
10. Students' textbooks reflected an even greater gap from Curriculum Document recommendations was even greater. In some instances, there were effectively no directions that cascaded from the Curriculum Document into students' textbooks.
11. The curriculum offered opportunities for students to develop the abilities necessary to do scientific inquiry, yet it did not foster chances for them to design their own scientific investigations around problems they encountered in their daily-lives, which would have deepened their understanding of, and ability to perform scientific inquiry.
12. The technology component of the curriculum invited students to develop their abilities of technological designs, but was not consistent across grade levels especially lower grades.
13. The curriculum failed to support students to develop an adequate understanding about the inter-relatedness of science-technology-society triad, therefore creating a gap in advocating for the history of science and developing student understanding of science as human endeavor.
14. The content of the curriculum was well structured around TIMSS domains and concepts. The scope of the curriculum was strong, yet its sequence showed some gaps especially around earth and space science.
15. The curriculum catered to assessment of learning relatively well. This catering was less evident when it came to assessment for learning and was not present in terms of assessment as learning.

Math

By comparing alignment indices of textbooks and Moroccan curriculum standards with best practices, the review team concluded the following:

8. Compared to best practice models, there is reduced emphasis on teaching vital content (such as data organization and processing) at the primary level in the Moroccan curriculum as evidenced by a decrease in the time allotted for instruction in these domains.
9. While best practice models are acceptably aligned with the curriculum standards in terms of math content, there is a relative misalignment between the best practice approaches and the curriculum resources. As a result, there exists disconnect between the curriculum and its resources; the more we move towards operationalizing the standards in textbooks, alignment with best practices weakens, and this reflects the authors' inability to translate the competencies contained in the curriculum document into situations and activities that support the mastery of learning. [93] Similarly,

[93] Blackburn, G. (2020). Skill mastery with competency-based learning. https://elearningindustry.com/skills-mastery-with-competency-based-learning-part-1

teacher guides falter in performing their directives due to reliance on verbatim copying of some paragraphs of the Curriculum Document without clear guidelines on planning instruction that focus on skills associated with the established learning objectives and pathways that harness the contextual opportunities for linking learning across different domains and topics.

10. There was an increased emphasis on knowing in the Moroccan curriculum in contrast to best practice models, which calls for greater focus on reasoning skills. From this conclusion it is easy to infer that explicit instruction is more prevalent than inquiry-based teaching in the math classroom. Presenting ideas directly to learners through lecturing to ensure basic knowledge minimizes learners' active role in reasoning about the knowledge they're learning. [94]
11. The curriculum lacks systematic virtual extensions that enable the facility to combine thinking practices on mathematics, technology, exchange of experiences and project-based learning. The absence of computational thinking skills in the curriculum document, and consequently, textbooks and teacher guides did not make it possible to provide real opportunities for technology use in the mathematics classroom.
12. The absence of compatibility between the competency-based approach to assessment and the evaluation standards does not allow accurate monitoring of mastery learning and the acquisition of math competencies.

QUESTION 2

TO WHAT EXTENT ARE THE SCIENCE, TECHNOLOGY, AND MATH MIDDLE SCHOOL CURRICULA ALIGNED WITH INTERNATIONAL BEST PRACTICES?

FINDINGS

This section follows the same subject-order as Q1, however, there is a separate technology curriculum at the middle level, which is reviewed following the science curriculum. The themes assessed within each subject are outlined at the start of each subject-specific section.

Science

Overall, the middle school science curriculum showed compliance with international best practice in some of its elements. Using the science curriculum review rubric criteria, the review team analyzed the Curriculum Document, teachers' guides and students' guides of randomly selected book series in full. As with the primary level review, findings have been categorized into 5 areas (inquiry; science and technology; science in social and personal perspectives; history and nature of science, content; and assessment), highlighting both strands: physical sciences, and life & earth sciences.

Inquiry. The Curriculum Document pointed out that lessons in science should be "planned around scientific inquiry" (p.59), inviting students to "develop plans for researching for solutions" (p.60). However, the scientific inquiry learning opportunities made available to students in textbooks showed a very limited margin for students to practice "doing inquiry" (recommended by best international practice) as opposed to "applying inquiry" (which diminished the role of the student to follow prescribed procedures and steps). So, students in both physical, and life & earth sciences were expected to be engaged in high order thinking skills attributed to scientific inquiry, but in reality they missed the core of it, and hence got involved in low level thinking skills attributed to the application of a cookbook

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[94] Zhang, L., Li, Z. How Does Inquiry-Based Scientific Investigation Relate to the Development of Students' Science Knowledge, Knowing, Applying, and Reasoning? An Examination of TIMSS Data. *Can. J. Sci. Math. Techn. Educ.* 19, 334–345 (2019). https://doi.org/10.1007/s42330-019-00055-9

type of experiments. Thus, there were discrepancies between what the Curriculum Document suggested versus what cascaded down to teachers' guides with even greater gaps in students' textbooks.

Science & Technology. Both the physical, and life & earth sciences showed a mismatch with international best practices in terms of securing the space for students to develop their understanding of the relationships between science and technology as well as technological designs. This was evident across all reviewed documents. The Curriculum Document provided a very limited and incomplete guidance pertaining to this aspect stating that: "students should be able to imagine technological products, draw them, create and producing them" (p.8). This is far from the international best practice that recommends involvement of students in deploying design thinking in relation to their understanding of the interconnectedness between science and technology. Moreover, no opportunities were noted for students to get involved in evaluating or communicating about technological designs. The only focus in this domain was acquiring knowledge, which goes in the opposite direction of international best practices.

Science in Social & Personal Perspectives. The middle school science curriculum (physical sciences and life & sciences) did not comply with international best practices when it came to connecting technology and science to society. There was limited guidance on involving students in global issues; such as, development of societies, preserving resources, sustainable development and limiting pollution. Furthermore, there was no sufficient guidance in the Curriculum Document pertaining to understanding the nature of the work of scientists and engineers in different contexts.

History & Nature of Science. The Curriculum Document showed very limited instructions on how to involve students in learning opportunities that would build their scientific literacy (p.11) and that addressed the historical path towards scientific knowledge (p.38). There were not sufficient details accompanying these general mentions of aspects to strengthen curriculum offerings. Thus, teachers' guides and students' guides missed student learning opportunities that would have allowed them to: (1) build a conceptual understanding of how science concepts are cumulative and result from the endeavors of several scientists across history; (2) understand the impact of technology on society: politically, economically and culturally; (3) distinguish that part of scientific inquiry is to evaluate the results of scientific investigations, reviewing the experimental procedures, examining the evidence, identifying faulty reasoning, pointing out statements that go beyond the evidence, and suggesting alternative explanations for the same observations.

Content. Using the scope and sequence matrices developed by the review team, the curriculum content was found to be incoherent, as it did not address all the units of the curriculum at all levels of middle school level. In fact, several gaps have been reported in the scope and sequence matrix of middle school physical sciences as well as that of the life & earth sciences.

> **Physical Sciences**: Grade 7 encompassed only two units: electricity and matter. Moreover, mechanics was not part of grades 7 and 8 curricula; and light was taught only in grade 8.
>
> **Life & Earth Sciences**. There was a lack of conceptual progression related to reproduction, generics, immunity, binding functions and geology across the three grade levels.

Assessment. The reviewers found links between the middle school science curriculum and international best practices in terms of assessment procedures, tools, and protocols. In fact, the Curriculum Document provided guidance for using varied approaches to assessing student learning, including, "oral, practical and written tests" (p. 48). It also provided a statement pertaining to "competency-based assessment based on pre-determined criteria" (p.28). The Curriculum Document recommended that learners should carry out self-assessment of their own learning" (p.46). All these statements and recommendations that were detected in the Curriculum Document indicated that assessment of/for/as learning was catered for within the Moroccan curriculum. However, the document contradicted the mainstream conceptualization of assessment by assigning dates for assessment for learning (formative assessment) restricting it to the middle and end of each semester; and assuring that the marks earned by students needed to constitute part of students' final scores. Thus, at the level of the Curriculum Document, a clear misunderstanding of formative assessment was noted and was exemplified through the description of how it was recommended in practice.

Moreover, the scrutiny of teachers' guides and students' textbooks, showed no evidence of competency-based assessment. Contrarily, assessment was limited to measuring the acquisition of cognitive knowledge by students and did not cater to acquired skills. Students did not enjoy any opportunity to be assessed on complex real-life contexts as prescribed by international best practice.

Technology
The technology curriculum in the middle school suffered from a serious distortion as it was not offered at all to students enrolled in grade 7. So a quick and immediate feedback from the curriculum review process was this finding which shakes the grounds for a strong and progressive curriculum that could flow smoothly across grade levels. The evaluation was therefore limited to grades 8 and 9, and only where technology was indeed offered to students. The review catered for 5 domains: research-based approach, data analysis & planning, technical skills & principles, links to math & science, and reflective practice.

Research-based Approach. The technology curriculum complied fairly well with international best practice at the level of the Curriculum Document. In fact, the Curriculum Document assured that a "research methodology needs to be adopted while investigating technological systems" (p.14), whereby students would be "assigned topics for them to research about, present and discuss" (p. 16). The teachers' guide instructed that this should be taking place "collaboratively between students where they would work together to arrive at solutions to real-life problems" (p.29). While these statements were in line with international best practice, they were not cascaded down to students' textbooks. Opposite to those recommendations, student textbooks did not leave any margin for students to pose their own questions and carry out their investigative research accordingly. Student textbooks suggested learning opportunities void of any chances for students to select a problem and work around it. In other words, all research activities were strictly guided. This is a feature in opposition to international mainstream of best practices.

Data Analysis & Planning. All the three documents: the Curriculum Document, teachers' guides and textbooks showed parallelism in addressing data analysis and planning. In fact, they all promoted 'prototyping,' 'analyzing data,' and to conduct 'feasibility studies;' however, they all missed opportunities for students to create their own plans and execute them. Thus, the curricula lacked integral elements which are highly recommended internationally as they teaches students to write objectives, set standards, create timelines, allocate resources, and create budgets. In addition to this, no documents advocated that students should collect data from end users of their technological designs and thus take advantage of such feedback in creating improved models and designs.

Technical Skills & Principles. While this domain was expected to be mainly focused on manual skills, it was highly theoretical, which deprived students of developing their skills as recommended by international best practices. Unfortunately, practical activities were limited to the implementation of electrical circuits based on printed circuit boards. This is probably linked to the absence of equipment and tools as well as workshops and laboratories that would have been conducive to desired compliance.

So, while the Curriculum Document made recommendations in this direction, those recommendations were not cascaded to students. Yet, one highly important mainstream international best practice was missing in all three documents: securing the opportunity for students to develop their technical skills starting with their designs, passing through testing and retesting of solutions, and arriving at technical products.

Likewise, the investigation of technical principles embedded within the curriculum showed weak alignment with international best practice. All the three documents under scrutiny showed that students were not provided with opportunities to explore the impact of new and emerging technologies on industry, enterprise, sustainability, people, culture, society and the environment, production techniques and systems. Moreover, students were not provided with opportunities to examine how critical evaluation of new and emerging technologies informed design decisions; nor occasions to consider contemporary and potential future scenarios from different perspectives, such the environment. Contrarily, all documents showed compliance pertaining to using information and communication technologies to promote their technological products, and catered to the aesthetic dimension of products conducive for marketing purposes.

Links to Math & Science. Unfortunately, the middle school technology curriculum shows no compliance with international best practices which suggest that technological designs should be based on students' acquired knowledge and skills of math and science. There was almost no guidance on mapping students' projects with their mathematical and scientific acquisitions, meaning that the technology curriculum was, in essence, floating on a separate island.

Reflective Practice. Reflective practice was not detected in any element of the middle school curriculum. This finding was not any surprise since students were following prescribed steps within a highly guided and structured procedures. The curriculum was devoid of opportunities for students to basically 'learn effectively,' given that reflection on practices is described in GCSE as being the corner stone for any technology curriculum offering.

Math

Similar to the analysis at the primary level, a review of the middle level curriculum was conducted along three dimensions: alignment of competency coverage with respect to the three math domains: Numbers and Algebra, Geometry, Data and Probability; alignment of cognitive level coverage; and alignment in relation to technology integration and assessment in mathematics.

Alignment of Content Coverage. In the domain of Numbers and Algebra, the review team computed a high alignment (Porter index=0.91) between best practice approaches and standards in the Curriculum Document with regard to content coverage. Reviewers found evidence of emphasis on numbers and algebra in the Curriculum Document (pp. 22-24-25-32-40) and the textbook (G. 1 pp: 8-7-13-16). However, the transition from primary education to middle school did not materialize as smoothly as required, especially the transition from arithmetic to the algebraic concepts. This finding manifested in detection of an early use of symbolic notation, where letters were inserted to express the relationship of converting the product into a sum (G 1 p. 10), as well as in a number of suggested exercises (G 1, p. 14, exercise 28-29 ...). This generalization of pattern relationships in a sequence using numbers, words, or algebraic expressions was not covered the textbook (with the exception of one exercise in G 2, 38, p. 80). Although what was required in the first year of middle school was only awareness-raising with respect to using symbolic arithmetic, sensitization did not mean using letters in one or two relationships without highlighting its significance as a pathway to algebra. Therefore, its inclusion in the first lesson of the program would be expected to create several difficulties for the learners, especially because they would have used letters in the primary school to express units of measure (meter=m, liter=L, grams=g).

The reviewers also detected high alignment (Porter's index=0.97) in geometry as within the Curriculum Document and textbooks. However, some vital geometric concepts were absent, such as identifying and drawing pairs of lines and rotations, and three-dimensional shapes were not linked to their two-dimensional representations sufficiently to broaden the learner's understanding of these concepts. Furthermore, geometry is considered a fertile field to learn proof and inference, however, this opportunity was not used as it should have been in textbooks, as students in middle school were not exposed to formulating proofs and expressing them verbally by following logical and coherent steps. The transition from observation and description in the primary school, to the stage of inference in the middle school was not sequential.

The data and probability domain was weakly aligned between best practices and the Curriculum Document (Porter index=0.44), as well as textbooks (Porter Index=0.44). This finding was confirmed by the high alignment between Curriculum Document and the textbook, which indicated that the textbook authors adhered to the provisions of the Curriculum Document to a certain extent, but that these fell below best practice standards. As with other domains, there were fundamental concepts, such as measures of central tendency, as well as probability, missing in the Curriculum Document and its supporting material.

Alignment of Cognitive Level Coverage. With respect to cognitive levels, there was a high alignment on the *knowing* (Porter index=0.83) and *applying* (Porter index=0.91) levels but weak alignment on the *reasoning* and *inference* levels (Porter index=0.50) between the Curriculum Document and international best practices. The Curriculum Document emphasized applications of properties or theorems in familiar situations (p. 27, p. 2, p. 65, p. 3, p. 38). Also for *reasoning*, the indexes of analysis, merging, synthesis, and drawing conclusions were present adequately in the Curriculum Document (pp. 24-11-44-33 ...).

However, in most textbooks, only basic features and arguments were demonstrated in the form of introductory activities or for presentation, with no indication of the methods and types of reasoning used, even in some solved exercises. This finding has implications for teachers, who often focus on abstractions, relying on textbooks without adopting these introductory activities into building concepts. A closer look at the textbooks under review, it was clear that students at the middle school level were not afforded opportunities to learn about the meaning of proof, nor about the methods of inference in mathematics.

Alignment of Technology Integration and Assessment. The review found sharp misalignment between the curriculum standards and best practices with respect to the use of technology in the mathematics curriculum. Minimal evidence was detected of any directions to use technological tools other than calculators to perform some operations, and an Excel program (pp. 104 and 105 only). Also, the review team did not find any indication of incorporating computational thinking approaches in the curriculum or its materials. Similarly, for assessment of learning, the review did not detect clear directives on the evaluation framework adopted for assessing student learning.

CONCLUSIONS

Science

Based on the above findings, the following conclusions were drawn:

16. The middle school science curriculum (physical sciences and life and earth sciences) showed limited compliance with international best practices. This weak compliance was noted at the level of the Curriculum Document, but the degree of compliance noted in teachers' guides and students' textbooks was even less due to weak cascading and misinterpretation of content.
17. The curriculum offered some opportunities for students to do scientific inquiry, yet did not support the development of their understanding about scientific inquiry as it did not foster chances for them to design their own scientific investigations around problems they encountered in their daily lives. Inquiry mainly took the form of "cookbook recipes" that limited the utilization of higher order thinking skills.
18. The curriculum showed weak compliance with international best practices in terms of addressing technological design thinking and making connections with society. Specifically, the team found weak compliance of the curriculum with international best practice in terms of advocating for the history of science, developing student understanding of science as human endeavor, and using scientific inquiry to evaluate the results of scientific investigations, examining the evidence.
19. The content of the curriculum showed numerous gaps interrupting the smooth progression of concepts across grade levels.
20. Assessment practices were inadequately structured, lacking the opportunity to adopt a competency-based approach that measures student understanding in complex situations. Formative assessment was misinterpreted and student self-assessment was not noted.

Technology

The review team determined the following technology related conclusions at the middle level:

21. The technology curriculum showed weak compliance with international best practices. Most egregiously, technology was not offered to grade 7 students, thus creating a serious gap in the curriculum.
22. The curriculum showed weak opportunities for students to create technological designs using a research-based approach. Contrarily, students were required to follow pre-determined steps and established projects, therefore they had few chances to work around problems of interest.
23. While students were given the chance to practice 'prototyping,' 'analyzing data,' and to conduct 'feasibility studies;' they were deprived of opportunities to create their own plans and executing them. This was opposite to international practice which emphasized the importance of enhancing student skills through self-led planning.
24. Dissent with international best practice was noted in terms of linking the curriculum to its counterparts of math and science; as well as reserving opportunities for students to reflect on their practice, and hence, act out reflective practices, and work to leverage the quality of their products based on such reflections.
25. Cascading from the Curriculum Document to students' textbooks was inconsistent and left gaps that contributed to non-compliance where research-based approaches, and data collection and planning were concerned.

Math

Drawing on the aforementioned findings, the review determined the following conclusions:

1. The content of the middle level standards presented by conceptual categories across the math domains portrayed an incoherent view of learning progressions across the curriculum and its supporting material that did not support the development of students' mathematical knowledge, skills, and understanding as proposed by best practice international models. The absence of vital math concepts, such as probability and statistics, made it less likely that students could develop a strong foundation that prepared them for more advanced math work at the high school level and beyond. Furthermore, the mathematical skills and understanding that students were expected to demonstrate at the middle level should have wide applicability outside the classroom. The best

practice models highlighted the need for students to apply mathematics to practical situations and gain understanding of topics and issues by reviewing data and statistical information.

2. In terms of cognitive processes, there was a need to balance between different cognitive levels providing more opportunities for students to engage in reasoning and using their mathematical thinking in various contexts and across subject areas. Developing the ability to reason, prove, justify, and communicate is necessary at the middle level to ensure a deeper understanding of concepts. Therefore, it is essential that the curriculum and its materials support students at the middle level to develop reasoning and analytical skills, make conclusions based on evidence, and to understand mathematics as a language for representing the physical world.
3. There was a missed opportunity in the Curriculum Document and learning materials to integrate technology that can advance learning in the math classroom. The absence of digital tools and computational thinking approaches from being incorporated as aids to visualize geometric concepts, solve problems and compare predictions with data, reduced the opportunities for students to fully engage in learning. In best practice international models, it is essential that students at various grade levels be trained to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. The review findings emphasize the need to use technological tools to help students explore and deepen their understanding of concepts.

QUESTION 3

TO WHAT EXTENT ARE THE MIDDLE SCHOOL SCIENCE, TECHNOLOGY, AND MATH CURRICULA ALIGNED WITH THE NEW PRIMARY SCHOOL CURRICULA?

FINDINGS

This section examines the science curricula, technology curricula, and then math curricula to determine alignment across the primary and middle levels within each STEM subject. The themes covered in each subject area are introduced at the start of each subject-section.

Science

Based on the scope and sequence documents created during the review process, the middle school science curriculum showed partial alignment with its counterpart at the primary level, but there were gaps in learning experiences and developmental progressions. It should be noted that the Moroccan science curricula adopted a spiral approach,[95] which refers to a curriculum design in which key concepts are presented repeatedly throughout the curriculum, but with deepening layers of complexity, or in different applications. A spiral curriculum is not simply the repetition of a topic. It also requires deepening the complexity of materials with each successive encounter building on previous one. The particular focus was on progression across physical sciences and life and earth sciences, where the spiral approach was not fully realized.

Physical Sciences. The content of the physical sciences curriculum at the middle school level was divided into four parts: matter & environment; electricity; light and picture; and mechanics. At the primary level, three units were offered, including: classification of matter, changes & properties; energy & its transmission, and forces & motion. The progression of concepts within the units of matter across the two levels appeared to be relatively strong. However, this unit was not offered to grade 1. Likewise, electricity shows progression across grades 2-9 and was missing in grade 1. However, light concepts show discontinuity across grade levels as it was offered only in grades 2-6 and grade 8. This also applied to mechanics which was missing in grades 1 and 2.

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[95] J. S. Bruner, The process of education. Cambridge, MA: Harvard University Press, 1960.

Life and Earth Sciences. Human health and interaction with the environment was offered in all grades of the primary school. However, it was offered only for grade 8 in three units: food, health education & binding functions and immunology. Moreover, the unit of 'living organisms, their functions and interactions with the environment' was offered throughout the primary grades, yet it was offered only for grade 7 of the middle school within the unit on 'the relationships between living organisms and their interaction with the environment.'
The unit of 'life cycles, reproduction & genetics' was offered to all grades at the primary school level, yet was offered only in grade 8 at the middle school level within the unit of 'reproduction of living organisms & the transmission of genetic traits in humans.' The unit of 'natural characteristics of soil and its resources' was offered to grades 3-6, while grade 7 was taught under the title:' external geological phenomena.' Additionally, the unit on 'Earth & the solar system' was offered to grades 3-6, whereas astronomy concepts were fully absent across middle school grade levels. Finally, the unit on 'the weather and climate' was offered to grades 3-6, but was not offered to any grade at the middle school level.

Technology

The middle school technology curriculum was limited to two classes (in grades 8 and 9). So, technology, which was offered as part of the science curriculum in the primary school, was discontinued at grade 7, and then resumed at grade 8. Not only this, but at the level of practice, the technology sub-team noted that technology as a subject was not taught in all schools at provincial, regional and national levels, in second and third middle school grades. This was attributed to the lack of resources, workshops and laboratories. Moreover, the Curriculum Document showed a mismatch between primary and middle school technology in terms of scope, sequence, and even basic terminology.

As far as scope was concerned, technology projects at the primary school were offered as an application at the end of science units. They took the shape of science projects simulating more "cookbook recipes." The elements of the technology project, which is considered the corner stone for any technology curriculum offering, were missing. As such, the way technology is addressed and handled in the primary school showed almost no congruence with its counterpart in the middle school.

At the level of the sequence, no progression was noted within the middle school curriculum, also within the primary school curriculum; and consequently across the two levels. This is further worsened with the disruption at grade 7 creating a serious and real gap.

Finally, the basic technology terminology utilized in the middle school curriculum, which better simulated international practices, was not used in the primary school technology curriculum. Thus, the two curricula at both levels showed no alignment.

Math

To examine the extent of alignment between middle level and the new primary level math curricula, the review team examined the scope and sequence matrices and focused on three major dimensions: 1) continuity of competences based on scope and sequence matrices; 2) alignment of cognitive levels; 3) extent of technology integration and assessment of learning.

Continuity of Competences. Based on content analysis of the scope and sequence matrices generated from grade 1 to grade 9, reviewers found, overall, a moderate to high alignment (Porter index= 0.68) between the primary level curricula and best practice models and a weak to moderate alignment (porter index=0.58) with respect to the continuity of content in middle level. Across the math domains, the review team found evidence of gaps in the progression of topics across a number of grade levels in primary and middle school levels.

In the domain of Numbers and Algebra, for example, a shift in math terminology was noted between grade 6 and grade 7 with a direct jump to using symbols not introduced earlier at the primary level to represent variables (*Almoufid fi Arryadyaat*, grade 7, p. 13, Activity 2: We consider the expression A consisting of a series of operations. / Activity 5: Calculate the following algebraic expressions). Representing the unknown using symbols had not been explored by students at the primary level, however, students are required at grade 7 to employ the use of variables and unknowns in solving simple and complex equations. Furthermore, real life contexts presented in problem solving at the primary level seemed to be absent in middle level content. Another gap detected related to the lack of proper conceptual transitions between primary and middle levels in dealing with complex numerical relations, taking into account symbolic and abstract representation, and using mathematical properties for interpretation and inference.

Furthermore, a sharp divergence of methodologies in presenting the mathematical concepts was apparent. Unlike the primary school, there was a minimal adoption of exploratory situations in the middle school level where students are able to construct their understanding from real life contexts. Lessons typically start directly by defining mathematical rules and properties, then working on drill and practice tasks framed within context-free exercises.

In the measurement domain, a core component of the mathematics curriculum, [96] reviewers noted an absence of extensions that remained associated with the primary level. A lack of concentration on geometric measurement at the middle level failed to lay a sensory and conceptual foundation for students to learn arithmetic with fractions and to engage in problem solving activities in everyday life. Similarly, there was a misalignment on data and statistics domain between primary and middle levels. The gap was attributed to the recent inclusion of the field of organizing and processing data in the new primary curriculum. In best practice approaches, students build on the knowledge and experiences in data analysis developed in earlier grades, then develop a deeper understanding of variability and more precise descriptions of data distributions in preparation for middle grades. [97]

Alignment of Cognitive Levels. With respect to consistency on cognitive levels, there was a weak focus reasoning and inference making. Although the objectives of some numerical activities are based on concepts acquired at previous grade levels in the same domain, the formulation of the objectives did not reflect a continuity in cognitive processes. For example, in grade 7, one of the content objectives is "Knowing the sum or the product and indicating its terms" instead of a formulation that built on the learner's previous knowledge of the concepts of sum and product, and reinforcing them (*Almoufid fi Arryadyaat*, P: 8-9, p: 9-10-11-12).

Furthermore, the review found emphasis on basic application of computations with natural integers in grades 5 and 6 at the primary level. Such emphasis persisted in the middle level where students used drill and practice in the same way as they did in earlier grades. Additionally, the review found an absence of vital topics, such as, early notions of proportionality, probability, statistics and proofs in grades 1-6. These are critical topics that lend itself to higher order thinking beyond the primary level, and their absence has created a void in the use of reasoning and inferences, meaning there are less opportunities for middle level students to experience such advanced levels of cognitive processes.

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[96] OECD(2018). PISA 2021 Mathematics Framework

[97] Mullis, I. V. S., & Martin, M. O. (Eds.). (2017). *TIMSS 2019 Assessment Frameworks*. Retrieved from Boston College, TIMSS & PIRLS International Study Center website: http://timssandpirls.bc.edu/timss2019/

Extent of Technology Integration and Assessment of Learning. The review team noticed evidence of a discrete separation between the primary and middle level technology integration across the curricula and its supporting material. Such disconnect prevented any attempt to examine the continuity of technology across grade levels. The weak use of technology-supported instruction at the primary level was even more prominent at the middle level. Reviewers attributed this to the few relevant activities that lend to explorations using technology on one hand, and the absence of an infrastructure that supported digital technology usage in the mathematics classroom on the other.

Another finding related to technology integration at the primary and middle school was related to missed opportunities to reinforce concepts for teaching math that necessitated hands-on explorations using technological tools, such as measurement and geometry. Moreover, the absence of goals related to training in the use of technological tools in the Curriculum Documents, i.e., scientific calculator, made it easy to for these to be overlooked even when opportunities emerged (*Almoufid fi Arryadyaat*, p. 8: to know how to do an arithmetic with or without parentheses while respecting the rules of priority by using a calculator").

With respect to assessment of learning, reviewers noted comparable assessment practices between primary and middle levels, however, there was only a weak association with assessment techniques recommended by best practice models. Additionally, the review found poor compatibility between assessment approaches at the primary and middle levels and techniques that aligned with the requirements of competency-based curriculum. Competency-based curricula establish the principles of personalized and mastery learning, [98] hence assessment of learning is conducted using multiple sources of evidence and proper metrics to measure learning gains and delineate trajectories toward mastery. The absence of multiple assessment practices was a road block in making valid inferences about student performance and their level of mastery of math concepts and skills.

CONCLUSIONS

Science

Based on the above findings, the review team drew up the following conclusions related to the alignment of science across grade levels.

1. The middle school science curriculum showed partial alignment with its counterpart at the primary school level.
2. The alignment between the physical sciences curriculum in the middle school and the new primary science curriculum is relatively stronger than that of the life & earth sciences.
    a. Many of the physical sciences concepts were addressed across grade levels with increased levels of complexity.
    b. Few drawbacks were detected with the unit on matter, though these were elevated within the units on light and mechanics.
    c. As for the life and earth sciences, alignment was also partial with the primary school science curriculum; yet, the review evidenced more gaps and discrepancies.
    d. The most intense discrepancies were noted in the units addressing astronomy, weather & climate.

Technology

The following conclusions relate to technology alignment between primary and middle levels:

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[98] Blackburn, G. (2020). Skill mastery with competency-based learning. https://elearningindustry.com/skills-mastery-with-competency-based-learning-part-1

1. There is no alignment between technology curricula of the middle and primary school.
2. A clear gap was detected at grade 7 where no technology curriculum was offered to students at all.
3. The technology curriculum was not offered even at grades 8 and 9 in some schools at provincial, regional and national levels, as per the review team, who justified this by highlighting the lack of resources both human and material.
4. Within each grade level discrepancies and gaps existed: no logical progression across grade levels was noted neither at the level of scope, nor at the level of the sequence of the curriculum.
5. The technology curriculum did not utilize the same terminology consistently across grade levels.

Math

Drawing on findings regarding the extent of agreement between the new primary and middle level curricula, the review concluded the following:

1. Lack of consistency between instructional methodologies adopted at the primary and middle levels, with sudden shifts from concrete, context-based approaches to abstract, decontextualized experiences. Research on best practice international models have identified developmental sequences or learning trajectories along which children develop and a set of instructional activities that help children move along that path. [99] Therefore, well-structured and consistent instructional activities are necessary to help students develop specific mathematical abilities and acquiring behavioral milestones along these trajectories.
2. There was an imbalance and lack of coherence in the conceptual progression and sequencing of content required in approaching and constructing math concepts from primary to middle level. The expansion of math concepts from primary to middle levels was weakly aligned with students' cognitive development and the logical structure of mathematics. Therefore, grade-level coordination of standards across domains or conceptual categories was insufficient.
11. There was agreement between the primary and middle level curricula in terms of reliance on employing "knowing" and "applying" cognitive processes rather than "reasoning" and "inference making." These high order cognitive processes require time and practice to develop, thus an early exposure is necessary to build competency and confidence.
12. Technology integration was almost absent in both levels due to the lack of instructional activities that promoted explorations using digital and technological tools. Also, the shortage of diverse assessment approaches to measure student learning toward mastery [100] was not aligned with competency-based approaches.

QUESTION 4

IN WHAT WAYS ARE THE CURRENT SCIENCE AND MATH CURRICULA COMPLIANT WITH INTEGRATED STEM APPROACHES IN THE PRIMARY SCHOOL?

FINDINGS

Science and Math Integration in STEM

Since the new primary curricula do not specify standards to teach technology as a content area, the review of STEM integration focused on possibilities for science and math alignment with integrated STEM methodologies. To examine the degree of compliance between the new science and math curricula and its materials (textbooks, teacher manuals, etc.) at the primary level with international best practice approaches in integrated STEM, the review team computed percentages of alignment on seven

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[99] Clements & Sarama (2009). Learning and Teaching Early Math: The Learning Trajectories Approach, Routledge, p. viii.
[100] Blackburn, G. (2020). Skill mastery with competency-based learning. https://elearningindustry.com/skills-mastery-with-competency-based-learning-part-1

indicators and determined the strength of alignment using arbitrary critical values: [101] (1) integration of motivating and engaging contexts, (2) engineering design, (3) integration of science content, (4) integration of mathematics content, (5) (student-centered) instructional strategies, (6) teamwork, and (7) Information technology and communication. As a result, the following findings emerged:

In terms of **integrating learning contexts** in mathematics and science by combining them across contexts that are close to the real life of the learner, the review found an overall weak to moderate alignment, [102] (45%), between integrated STEM best practices and the curriculum and its materials. Specifically, alignment rate with best practices was higher in terms of context convergence between science and mathematics with the curriculum document (63%), than with the textbooks (36%), and teacher manuals (36%). The weak alignment of learner's textbooks and teacher guides in science and mathematics reflected the weak reliance on integrations in contexts, with a positive trend towards mathematics employability and integration in sciences (Curriculum Document p. 192- Determining the expansions of mathematics in daily life / in the rest of the school subjects; "General objectives for teaching science: developing scientific research skills… retrieving data, recording data and considering scientific evidence to draw conclusions", p. 254). The review detected a set of indicators that show some faltering in the level of alignment with best practices:

1. Absence of grade-level coordination and sequencing of standards in grades 1-6 in the Curriculum Document across subjects or conceptual categories, which in turn undermined the development of clear guidelines for curriculum organization, textbook content, and teacher guides (*Almoufid fi Arryadyaat* , Grade1*,* p: 10-11-12; *Alwadih fi Annachaat Al-Ilmie*, Grade Five, pp: 16 - 17-18-19, where the topic of nutrition and health employs the concept of proportionality and conversions in energy value units of measurement - but simultaneous mathematics lessons concern geometry and time measurement). Compounding this discoordination was the lack of explicit references linking scientific practices in the two subjects in teacher's guides and pedagogical directives.

2. Despite emphasis in pedagogical directives on providing stimulating contexts, textbook activities were not successful in providing interesting and authentic contexts for learning ("Using the environment in building the instructions: by employing the learner's environment in terms of problems, resources and physical capabilities, so that learning is realistic, similar to what is happening in environment and real life", pedagogical directives, p. 194). The components of the aforementioned science content were not presented in the directives as subjects independent of the learner's life, but rather by invoking the personal, social and environmental context of the learner (pedagogical directives, p.261, p.270).
3. The topics taught in mathematics and science in the primary school did not provide enough information to appeal to learners into becoming familiar with STEM specializations and occupations in the practical sphere.

In terms of adopting **engineering design** thinking, reviewers found a weak to moderate alignment of 41% between integrated STEM best practices, the curriculum and its resources. Specifically, in the pedagogical directives document, the alignment indicator for the adoption of engineering thinking / design reached 55%. Technology projects proposed in the science curriculum proved missed opportunities for the learner to carry out engineering design in simulated or partially realistic situations. The understatement of adopting engineering design thinking meant that there were not real possibilities for training, use of engineering design, or employment of thinking and creativity to solve problems utilizing the knowledge and skills acquired in the math and science curricula (The pedagogical directives

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[101] Landis, R., & Koch, G. (1977). The measurement of observer agreement for categorical data, *Biometrics, 33* (1), 159-174.
[102] Landis, J., & Koch, G. (1977). The measurement of observer agreement for categorical data. *Biometrics, 33*(1), 159-174. doi:10.2307/2529310

document, p. 259 "The aim of underlining technological projects is to develop the ability to solve problems in real life, to harness their achievements in knowledge , design and manufacturing skills, in order for them to develop positive attitudes and to have the opportunity to work as young engineers.").

Furthermore, alignment of learner's science textbooks as well as teacher guides with integrated STEM best approaches for the adoption of engineering design thinking was very weak (34%), indicating minimal emphasis on accessible learning activities that invite intentional and purposeful design-based problem solving (The Guide to *Al-Manhal fi Annachaat Al-Ilmie*, Grade 3, p. 282, designing a model representing the sun and the earth; p. 36 "A project to manufacture a simple phone."). While reasoning activities usually designed to link engineering with science and mathematics were scarce, reviewers noted some contexts that required the use of mathematical inference to justify and support engineering design choices (Learner's textbook *Aljayyid fi Arryadyaat, p.50:* The engineering design of a crane in relation to the principle of rotation and displacement).

In terms of **math integration in science,** a weak to moderate alignment (56%) was reported across curriculum documents and its materials. Particularly, the review team noted a moderate to high (79%) alignment for opportunities that supported an integration of math in the science curriculum in grades 1-6 (pedagogical directives, p.: 195 "Using proper mathematical discourse"). Whereas in learner's science textbooks, the alignment for employing math concepts in science was found to be weak to moderate (45%) compared to 56% with science teachers' guides. Reviewers noted that the activities examined in the textbooks under study did not provide opportunities for the learner to use math principles and language to assimilate and internalize scientific concepts. Also, the Curriculum Document lacked any reference to incorporating mathematical language in understanding science.

Furthermore, disconnect between the pedagogical directives in the curriculum document and the textbooks and teacher guides was observed when, for example, the pedagogical directives of the new primary science curriculum emphasized the necessity of providing opportunities to the learner to acquire and apply scientific approach skills, i.e., scientific practices and scientific thinking skills, including observation, analogy, classification, inference, deduction, prediction, communication, controlling variables, constructing hypotheses, and conducting experiments. However, the activities of the science learner's textbooks did not provide opportunities for training and engaging in scientific practices. Also, while some guidelines for integrating math in science teaching were detected in the science curriculum directives such as "Utilizing the display and processing of school data" (curriculum document, p. 301), little evidence of math integration was reported in the textbooks and teacher guides.

In terms of **integrating science in teaching math**, the overall alignment across math curricula and its resources was weak (curriculum document: 46%; Textbooks: 41%; Teacher guides: 41%) indicating missed opportunities to harness intersections between science and mathematics. The inclusion of technology projects at the end of every unit did not provide clear opportunities for the learners to use their achievements in science and mathematics to address an engineering / design challenge. Some activities provided opportunities for the learner to use data within a scientific context, but there were insufficient opportunities to collect and analyze data and to use the data collected to test scientific hypotheses, or the technological designs that students could work on.

With respect to integrating **cooperative and communication practices** in learning mathematics and science, reviewers allocated an overall a weak to moderate alignment (58%) across the curriculum documents and its resources in math and sciences. However, a moderate to high alignment (70%) was found with pedagogical directives in integrating standard of cooperation and communication in teaching science and mathematics, but the degree of alignment decreased in teacher's guides (52%) and learner's textbooks (52%) that were unable to provide real situations about learning through collaborative building. For example, the Curriculum Document called for the need to adopt twenty-first century skills, p. 251, 252, 260. However, the shortage of opportunities for employing digital technologies that lend to group-based cooperative and project-based learning, and the weak reliance on various representations responding to the diversity of needs and interests, prevented opportunities for student to engage in collaborative and cooperative learning. The formative and investigative activities proposed in the Curriculum Documents required the learner to cooperate with others, and suggested opportunities for sharing the possibilities of employing evidence-based reasoning in methods of communication between learners. Furthermore, the adoption of group projects and technology application by the end of each unit in math and science brought to action the principle of cooperation and communication in learning mathematics and science. However, reviewers noted that advocating for these activities at the pedagogical directives level did not necessarily imply that such opportunities are concretized as real possibilities to engage the learner in collaborative cross-disciplinary explorations (Teacher's Guide to *Almoufid fi Annachaat Al-Ilmie*, p. 66,"The project is to be implemented personally or in cooperation with his classmates in the classroom").

With respect to the use of **information and communication technology** in science and mathematics and the combination between them, the review team found a very weak overall alignment (33%) with weak to moderate alignment in pedagogical directives (58%) and almost negligible alignment (21%) with textbooks and teacher guides for math and science (The Curriculum Document, Information and Communication Technology paragraph p. 267). While the reviewed math textbooks did not provide activities that required the learner to use information technology in research and communication to analyze information, solve problems and/or make decisions, a few science textbooks included some activities that referred to the use of digital technology such as: software, simulations and graphics (*Al-Mukhtar fi Annachaat Al-Ilmie*, year 2, p: 46; *Al Wadih fi Annachaat Al-Ilmie*, Grade Five, p. 19, 'I enhance my learnings by searching on the Internet). Additionally, reviewers detected very few activities referring to the use of ICT in research (Al-Mukhtar fi Annachaat Al-Ilmie, Year 2, page 47: 'I search the Internet for plants whose stems are similar to the stems of the following plants and take notes of them'). However, activities included in these textbooks provided insignificant opportunities to use digital and non-digital technological tools during learning such as: a protractor, a ruler, and a thermometer, hereby limiting the possibilities for learners to use ICT to communicate and/or collaborate on a technology project.

CONCLUSIONS

Informed by the findings to ascertain the primary level curriculum's degree of compliance with integrated STEM approaches, the review reached the following conclusions:

1. There were contextual possibilities to integrate science and mathematics contents across the six grades, based on the moderate alignment between integrated STEM approaches and pedagogical directives in terms of integrating learning contexts relevant to the learner in mathematics and science. However, opportunities for context integration dissipated in learner's textbooks and teacher guides. Weaknesses were evident in that the Curriculum Documents' inability to combine science and mathematics in learning materials. For example, textbooks offered few challenging, real-life contexts that could enable the mobilization of resources, the lack of which hindered the students' ability to implement a diversity of solution strategies and employ critical and creative thinking.
2. With respect to content integration, the correlated nature of science and math concepts at the primary level and the possibility of harnessing cross-cutting math concepts such as data organization and measurement in science teaching, remained unexploited terrain. There were no stipulations about field utilization and its synchronization with science units, which resulted in a lack of activities relating to analogy and data organization in science teaching. Reviewers noted the potential to integrate mathematics and science in pedagogical directives, however, little to no evidence of integration was detected in textbooks and teacher's guides to enable the incorporation of mathematical language in science activities in a clear and conscious manner. There was only a faltering

use of mathematics in science teaching. Furthermore, there were insufficient opportunities for the learner to apply scientific skills in learning math, despite the myriad opportunities to use investigative methods to develop learners' mathematical skills.

2. Weak stipulations to adopt engineering thinking and design in the curriculum document and its material impeded opportunities to build progressive activities. For example, the directive to incorporate technology projects at the end of every unit in math and science, in the Curriculum Documents provided real training opportunities to integrate engineering design with science and math. Such possibilities were dodged by the absence of explicit guidelines to incorporate engineering thinking / design techniques that facilitated a conscious and systematic training in the strategies associated with it. The absence of individualized, skill-based goals for training in engineering design mechanisms, compounded by a weak integration between mathematics and science, did not allow for design-based approaches in textbook activities.
3. There is discrepancy between opportunities provided in the Curriculum Document that adopt the investigative approach in science teaching, and the opportunities in the learner's textbooks to acquire and apply the scientific approach skills such as observation, analogy, classification, inference, deduction, prediction, communication, controlling variables, constructing hypotheses, and conducting experiments. The consistency indicators for pedagogical directives, learner's textbooks, and teachers' guides were close to moderate alignment with best practices in terms of using mathematics in science teaching.
4. The Curriculum Document did not direct the teacher's guides and textbooks to introduce integrated STEM concepts to learners, as it could have by linking mathematics and science to ways they could be used in STEM-related careers. There were limited opportunities for learners to use their mathematical achievements to collect and analyze data, to tap on data to test scientific hypotheses or technological designs and use measurement tools to think about sources of error in a simulated process hindered students' chances of experiencing the work of scientists or engineers.
5. There was clear indication in Curriculum Documents that ICT should be integrated in science and mathematics, as evidenced by statements in the directives about the adoption of the technology projects, and the inclusion of computer science as a subject at higher grades. However, this intention fell short of proposing opportunities for teachers and learners to utilize different types of technologies, especially digital, that could have supported the inclusion of multimodal representations that respond to students' diverse needs and interests, and maximize cooperation and diversification of evidence, solutions and strategies. The weak employment of ICT in problem-solving and/or decision-making, and the absence of digital technology expansions that could have enabled the use of content simulation tools and programs, restricted the inclusion of project-based activities, thereby reducing problem-solving and collaboration between learners.
6. Integrated STEM approaches and the Curriculum Document were aligned in terms of the standards of cooperation and communication in teaching science and mathematics. However, the degree of alignment decreased in teacher's guides and learner's textbooks, which were ultimately unable to provide real situations that might motivate curiosity in STEM and foster a sense of belonging among students through team-based approaches to solving real world challenges. [103]

QUESTION 5

IN WHAT WAYS ARE THE CURRENT SCIENCE, TECHNOLOGY AND MATH CURRICULA COMPLIANT WITH INTEGRATED STEM APPROACHES IN THE MIDDLE SCHOOL?

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[103] US Department of Education (2016). STEM 2026: A vision for innovation in STEM Education. Office of Innovation and Improvement.

FINDINGS

To examine the degree of compliance between middle level science, technology, and math curricula and integrated STEM approaches, the review team focused on seven major dimensions in the STEM checklist:

1. Integration of Motivating and Engaging Contexts
2. Engineering Design
3. Integration of Science Content
4. Integration of Mathematics Content
5. Student-centered Educational Strategies
6. Cooperation and Communication
7. Information Technology and Communication

These seven points are reviewed by subject below, i.e., (1) Science integration in STEM, (2) Technology integration in STEM, and (3) Math integration in STEM. However, the interpretation of findings, that is, the conclusions, were drawn jointly across the three subjects.

SCIENCE INTEGRATION IN STEM

With regard to **the learning context** in science, reviewers examined alignment of the two science concentrations independently at the middle level: life and earth sciences(LES) and Physical sciences (PS). For both subfields, the index of alignment between pedagogical directives and integrated STEM approaches was weak to moderate (67% for LES and 53% PS). Specifically, a number of physics concepts were identified that could naturally be integrated with LES: the unit of matter in physics, for example, dealt with the concepts of gases and atmosphere, matter, particles, energy, physical states of matter and melting, fusion, freezing, pressure, heat, molecules, atoms and chemical reaction. The correlation was also obvious in using laboratory tools and materials for measurement, screening and experimentation. However, a time disparity was noted in the instructional sequencing of many concepts that were acquired in physics and that also appear in LES (the first term of the middle school as a model). Also, in LES, there were efforts at linking learning to daily life (p. 32): "What is learned at school will not be functional unless it arises from situations close to the students' real life, within their fulfillment of projects or search for appropriate solutions to specific problems that motivate learners and encourage them to conduct research."

The interdependence between LES, physics, and mathematics was manifest in building learnings in these subjects within a problem-solving method or a problem-based situation. To illustrate, the use of measurement: measuring volume, masses and capacity, measuring temperature and measuring time and velocity, then order and regularity of minutes, and reading the water bill, etc., as well as the graphic expression (the concept of coordinates, bar graphs, line graphs, tables, charts, diagrams ...) and logical inference and abstraction, are all cross-cutting notions commonly employed in LES and PS. An interconnection was also indicated in the pedagogical directives between LPS, PS and technology through the use of modeling and project work.

On the other hand, reviewers found weak to almost negligible alignment in the teacher's guide (53% in LPS, and only 27% in physics) and learner's textbook (only 27% in LPS and physics). The proposed learning activities in the student textbook lacked situations that stimulated learner engagement in discovery learning and creative expression.

With regard to integrating **design/engineering thinking** in science, the review team found a disproportionate alignment in the Curriculum Document with international integrated STEM approaches in LPS and PS. For example, the alignment for LPS was moderate to high (72%), but was very weak (28%) for physics. In LPS, the pedagogical directives in the Curriculum Document focused on giving learners the opportunity to ask questions, identify and present the scientific problem: the list of targeted skills (p. 12); How to teach with competencies (p. 32); and Features of life and earth sciences Class (p. 36). There was also evidence of project-based pedagogy (p. 43) illustrated as: "A method based on presenting students' projects, in the form of learning situations revolving around a clear social problem, which makes the students feel a real disposition to research and solve it according to their abilities, under the guidance and supervision of the teacher, by relying on the practice of self-directed activities. This method stems from blurring the boundaries between academic subjects, which overlap so as to focus on a set of purposeful activities."

In physics, the pedagogical directives referred to choosing an interesting and stimulating situation for thinking, relevant to the learners, then tracking their representations, helping them grasp the problem and urging them to think and pose questions (p. 59). However, the Physics Directives (p. 60) referred to the project method without specifying the actual procedures to be applied to specific parts of the curriculum. Among the project steps specified were: a listing of sources and constraints, work plan, analysis of expected obstacles, identification of methods and techniques, and time management.

For teachers' guides (a sample reviewed was printed in French) negligible alignment was noted with integrated STEM approaches in LPS (11%) and physics (17%). In LPS, teacher guides barely explained the steps of the investigation approach, starting with identifying the problem. In physics, the teacher's guides addressed the stages of applying the investigation approach in classroom practice without referring to the use of engineering design thinking to solve the problem under study.

In student textbooks, there was a discrete separation with integrated STEM in LPS as observed by the absence of learning activities with regard to project planning, implementation and evaluation. In physics, there was almost a negligible alignment (17%) with the student textbooks. For example, there was some indication of real life context integration, in addressing the risks and safety rules associated with the use of household electrical current, with burning, exposure to sunlight, speed of movement, chemical reactions and the effect of substances on the environment, etc.

Overall, review detected a shortage of opportunities for learners to engage in engineering design, to participate in identifying problems, to review and re-work on their designs, and to develop critical and creative thinking. Furthermore, the science curriculum was found to have provided learners with only very limited opportunities for engineering design in realistic situations that incorporated STEM subjects. Finally, information regarding STEM- related specializations and careers was also lacking.

In terms of **connecting different branches of science**, as reflected in the pedagogical directives, reviewers found a moderate to high alignment between LES (75%) and integrated STEM approaches and a weak to moderate (67%) alignment between physics and chemistry and integrated STEM. The LES pedagogical directives document focused on learners acquiring and practicing skills of the scientific approach (p. 11 and p. 36). The pedagogical directives for physics (pp. 16-19-20-28-38-44) supported linking science to everyday life and with other curricular subjects. Also, learning situations in physics adopted the investigative approach so that learners act "like young scientists who manage their learning activities according to stages similar to the steps of the scientific approach, such as formulating the scientific problem, proposing hypotheses and testing them in different ways, collecting data, and reaching conclusions" (Curriculum Document, p. 58).

In textbooks and teacher guides, there appeared to be a weak to moderate alignment with international approaches in physics and chemistry (67%) and earth sciences (50%). The learning activities orienting learners in life and earth sciences to use graphic expression and acquire scientific approach skills (observation, analogy, analysis, data linking, interpretation, inference, proof, deduction ...) were scarce. Also, these activities did not allow learners to practice the scientific approach in an integrated manner, to propose hypotheses without thinking of steps to verify them, nor to analyze experimental results without linking them to learners' hypotheses or explanations.

With respect to **employment of mathematics concepts in science**, the review found that the pedagogical directives and international approaches aligned highly (75%) for earth science and moderately (67%) for physics and chemistry. For example, reviewers noted a focus in the LES directives on "Searching for information from various sources" (p. 11); Utilizing data obtained to test scientific hypotheses (p. 32); "Graphic expression represents the outcome of observations with graphs or charts, and represents some biological or geological phenomena that can be measured by data such as bar graphs, curves, and line graphs." (P. 36). Similarly, in physics, there were math connections suggested in activities where learners were asked to conduct a quantitative study using measuring devices to collect experimental data.

While there was a moderate alignment (67%) in physics textbooks with integrated STEM models in terms of integrating math ideas, reviewers noted weak (42%) alignment in earth sciences. There were possibilities for students to use mathematical skills in learning activities, but opportunities to use math to test hypotheses or engage in problem solving or modeling were relatively slim in LES student textbooks. In physics, however, experimental data and results were used in building concepts and verifying physical laws.

With regard to **educational strategies** that facilitated integration, reviewers determined that the pedagogical directives and integrated STEM approaches were highly consistent with educational strategies with 89 percent compliance in earth sciences and 94 percent in physics and chemistry. In the current middle level science curriculum, approaches to science teaching through experimental activities now offer learners more independence to build their competencies through the fulfillment of tasks that require high-level capabilities and skills. For example, the Curriculum Document's pedagogical directives for LES indicated: "What is learned at school will not be functional unless it arises from situations close to the students' real life, within their fulfillment of projects or search for appropriate solutions to specific problems that motivate learners and encourage them to conduct research. The investigation is based on a clear methodology." Similarly, in teacher guides, reviewers detected high alignment (89%) in LES and 94 percent in physics. It was clear that the investigative approach was laid out and explained in the teacher's guides. However, this finding did not apply to student textbooks where a weak to moderate alignment (61%) was reported**.** Despite the fact that there was an intention to utilize student-centered strategies to engage learners in self-directed activities to develop their problem solving reasoning skills, these intentions were not concretized in the student textbooks, where the focus remained on directing students to complete fragmented tasks by gradually relying on specific information given to them, without affording opportunities to think independently and creatively.

As to **cooperation and communication** in science, the review team identified a weak to moderate alignment index for LES (61%) and physics and chemistry (67%). This finding was supported by LES curriculum, which included the following directives: "Oral, written and graphic communication" and "Integration into a working group" (p. 11); "Expressing and arguing an opinion" (p. 12). Similarly, in the Physics Directives (p. 15) talk about "communication in all its forms: reading, writing, listening, speaking, understanding the language of dialogue, understanding the written language, mathematical language, the use of symbols, dialogue literature, persuasion of a certain view." With student textbooks, however, the alignment with integrated STEM approaches was weak to moderate in LES (50%), and in physics and chemistry (61%). Reviewers attributed this result to the fact that most of the indicators on cooperation and communication were related to the practice within classes, not reflected in the student textbook (communication and cooperation between learners - individual responsibility in working within the group).

With regard to the **use of information and communication technology**, the alignment between pedagogical directives and integrated STEM approaches was high in earth science (75%) as well as in physics and chemistry (83%). The pedagogical directives on LES in the Educational Aids, chapter (p. 44) stated: "The means related to information and communication technologies in education (ICTE) in the subject of life and earth sciences such as: CD-ROM, software, data projector, computers." While the curriculum directives capitalized on the use of information and communication technology to support teaching and learning, teacher's guides called for the use of the digital resources available on the ministry's website or the scientific videos posted on Internet. Textbooks, on the other hand, were weakly aligned (50%) in LES where activities rarely directed learners to utilize (ICT) in information analysis and problem-solving. While the life science directives required the learner to use ICT in research or in simulation of content, the textbook inadequately supported the use of (ICT) in information analysis and problem-solving.

TECHNOLOGY INTEGRATION IN STEM

On the **learning context** dimension, the review found high alignment (80%) between the technology directives and international approaches to integrated STEM in terms of providing motivating learning contexts in harmony with the rest of the subjects. However, reviewers asserted that the learning contexts needed to be directed more towards STEM-related specializations. The textbooks and teacher guides instead were weakly to moderately (60%) aligned with integrated STEM approaches. For example, there were scattered instances in the textbooks that included situations for solving real problems that took into account different perspectives and multiple solutions.

With regard to **design / engineering thinking**, reviewers found weak to moderate alignment with integrated approaches to STEM in pedagogical directives (66%), teacher's guides, and textbooks (55%). Specifically, no congruence was noted between technology directives and materials (textbooks and teacher guides) with regard to 'thinking while doing' (Pedagogical directives, p. 8)**.**

In terms of **integrating science** in technology**,** high alignment (75%) was reported between pedagogical directives and international approaches to integrated STEM in adopting the approach of investigative inquiries and real life problem-solving (pedagogical directives, p. 8). However, reviewers found weak alignment (50%) between the teacher's guides as well as student textbooks and integrated STEM models due to the lack of emphasis on scientific investigation in technology projects.

With regard to **incorporating mathematics with technology,** high alignment (75%) was also found between pedagogical directives and integrated STEM approaches, but the use of mathematical language remained relatively weak and limited to prior achievements ("Establishing an integration between the theoretically acquired knowledge of the learner and his applied skills", Pedagogical directives, p. 8). However, alignment between the teacher's guide and the student's textbook in terms of using mathematics was weak (41%), especially in utilizing data and mathematical skills as a medium to support technological applications and visualization tools.

With respect to **educational strategies,** reviewers determined an almost perfect alignment (94%) between pedagogical directives and international approaches to integrated STEM although the delineation of these strategies lacked some details ("Adopting research methodology and structuring while studying multi-technology systems and problem-solving methodology during achievement-led learning", Pedagogical directives, p.14). Weak alignment (51%) was noted between the teacher's guide and the student's textbook regarding the adoption of educational strategies (51%), but there were no references to the approach of investigation/inquiry and problem-solving.

Regarding **cooperation and communication,** the review team found high alignment between the pedagogical directives (88%), teacher's guides and student textbooks (72%) in developing competencies in line with internationally recognized life skills. However, the proposed activities did not target higher order thinking skills such as reasoning ("Inspiring the spirit of teamwork and the desire to search and discover", p.8).

In terms of **the use of information and communication technology,** high alignment (83%) between pedagogical directives and international approaches to integrated STEM was noted in the use of information and communication technology. The alignment with teacher's guides and student's textbook remained weak to moderate (66%) due to insufficient activities that required problem solving approaches compatible with technological developments.

MATH INTEGRATION IN STEM

Regarding the **learning context** in math, the alignment between pedagogical directives and international approaches to integrated STEM was weak to moderate (50%). There were directives in the math curriculum document that called for the provision of interesting contexts for the learner "adopting the principle of excitement, suspense, curiosity and inquisitiveness, as well as attaching importance to the student's desires and preferences ..." (Pedagogical directives, P.14), and through the technological competencies to target "the ability to conceive, draw, create and deliver technical products" (Pedagogical directives, P.6). Contrastingly, reviewers reported negligible alignment (only 17%) between the textbook's and international approaches to integrated STEM with very limited exercises that provided interesting and engaging contexts for the learner (For example, Grade 9 textbook, p. 54 and 147).

With regard to **design/engineering thinking,** the percentage of alignment between pedagogical directives and integrated STEM learning was weak to moderate (55%). With the exception of implementing projects that have no impact, all indicators of this standard were present in a moderate percentage in pedagogical directives. For instance, there were some directives to training the learner on observation and analogy and on evaluating their observations by resorting to careful investigation and experimentation, grasping questions and presenting issues clearly and objectively (Pedagogical directives, p. 9). On the other hand, reviewers found that the alignment between the textbooks and integrated STEM was almost non-existent for this dimension, as the percentage of alignment was only (6%). There was no statement in the textbooks providing opportunities to the learner relating to engineering design in realistic situations or using critical and creative thought in STEM subjects.

In terms of **science integration with math,** weak to moderate alignment was reported between pedagogical directives (67%) and textbooks (58%) with integrated STEM approaches. The review identified a shortage of opportunities for learners to harness their achievements in science, to address a mathematical challenge, to acquire and apply the scientific approach, and to understand science by using mathematical language. References to integrating science in math instruction were made through a general directive to teachers ("Holding meetings with teachers of scientific subjects in particular is a necessary act because it helps to coordinate between these subjects and adapt various mathematical knowledge to better use it in other subjects," Pedagogical directives, p. 18 and 19).

With regard to **making connections within different branches of math,** alignment was found to be weak to moderate (67%) between pedagogical directives and integrated STEM approaches as reviewers noted some opportunities for the learner to collect, analyze and utilize data, to test scientific hypotheses and to acquire and apply mathematical skills (Pedagogical directives, p. 9, 10, 11). However, textbook's alignment rate remained weak (33%) as the use of mathematics was limited to acquiring and applying mathematical skills (Grade 8, p. 54) and there were no opportunities for the learner to collect, analyze and use data to model mathematical situations.

Regarding **educational strategies** in math, the alignment between pedagogical directives and international approaches to integrated STEM was high (72%) with a focus on the fundamental role learners play in the learning process (p. 12) and emphasis on activities employing strategies that encourage discussion (p. 3). Reviewers also noted some directives that encouraged opportunities for learners to participate in activities linking subjects to real life (p.16), and opportunities to use digital and non-digital technological tools within learning (p.16). Textbooks, on the other hand, were found to be weakly aligned (50%) with integrated STEM as the majority of activities did not target learning through inquiry. Textbooks did not employ strategies that encouraged evidence-based debate and dialogue where learners would be scaffolded to construct their own learning.

In terms of **cooperation and communication in math,** the pedagogical directives were weak to moderately aligned (50%) with international integrated STEM models. Reviewers noted a few instances calling for learners to cooperate with others, to express mathematical concepts in multiple ways, and to utilize evidence-based reasoning using communicative discourse. For example, “Achieving an organized activity within a group allows all students to participate” (Pedagogical Directives, p. 14). Also “Developing the student's ability to communicate mathematically by developing his ability to model and present a proof, clarify a strategy or solve a problem by adopting oral and written expression or using graphs, charts or algebraic methods." (Pedagogical Directives p. 10). However, textbooks’ alignment with international approaches to integrated STEM curricula was weak (33 %) as manifested in this standard “Expressing mathematical concepts in multiple ways and employing proof-based reasoning in the learner’s communication methods.” (Textbook Grade 7, P.26; Textbook, Grade 8, P. 68).

With regard to the **use of information and communication technology,** the review identified weak to moderate alignment (50%) between pedagogical directives and integrated STEM models. There were some directives that required the learner to use information and communication technology in research to analyze information, to solve problems and to take decisions (Pedagogical directives, p.11 and p.16), while the activities did not require the learner to use ICT to communicate or collaborate. Reviewers, on the other hand, reported no alignment (0%) between the textbook and integrated STEM approaches. The activities presented in textbooks did not require the use of ICT in research, communication, or content-specific simulation.

CONCLUSIONS

Science, Math, and Technology Integration in STEM

After a close examination of the potentials of alignment between best practice approaches in integrated STEM and science, math and technology curricula in middle level, the review team, drew the following conclusions:

1. There was a strong indication that the science, math, and technology pedagogical directives recognized the benefits of integrating STEM subjects to support more stimulating experiences for learners. This conclusion was premised on the tangible opportunities in the pedagogical directives that emphasized an integration of science, math, and technology topics in diverse learning contexts. Such integration was manifest in terms of contents, pedagogical methods and proposed didactic tools that correlated learning objectives and skills across subjects. For example, the directives that incorporated mathematical modeling using technology, provided motivating contexts for learning science. However, these aspirations were weakly operationalized in student textbooks and teacher guides, where inconsistencies prevailed in terms of what students were expected to learn and what they were actually studying in the textbooks. The learning activities across the textbooks, particularly in math, followed monotonous, less diverse approaches that did not support, as hoped, critical and creative thinking among learners. Such inconsistencies may create new knowledge gaps and challenge teachers' content knowledge across the three subject, adding risk to opportunities for learners to engage in high quality STEM learning.
2. The disparity in instructional programming, sequencing, and organization of subject units in science i.e., physics, life and earth sciences, and other subjects such as mathematics and technology did not facilitate an organized and smooth implementation of integrated learning across subjects within middle school. This lack of coordination between subjects prevented the organization of knowledge around big ideas and minimized students' chances to interrelate concepts and processes across STEM disciplines.
2. There was an absence of opportunities to engage in engineering design and systematic computational thinking to solve real-life situations, the shortcoming of which were particularly obvious in physics, math and technology, restricted resources for learners to incorporate integrated approaches and develop critical and creative thinking skills. Furthermore, the exclusion of technology limited possibilities for the learner to identify problems and use engineering design as a learning context to solve problems, to think while doing, and to employ their prior achievements in science and math to address an engineering / design challenge. The review team asserted that neither the curricula nor its materials (teacher's guide and student textbook) included the necessary elements for learners to practice engineering thinking.
3. There was a strong endorsement of student-centered educational strategies by the science, math, and technology Curriculum Documents as pedagogical directives significantly supported the actual involvement of the learner in building his learning within the framework of competency-based approach. However, no detailed specifications were provided on how to incorporate these guidelines in the textbooks, teacher guides, and consequently, in classrooms. The activities proposed in the curriculum materials rarely used real-life investigation approaches and problem-solving to engage the learner. Therefore, the student remained merely an executor of the tasks previously laid down in activities and was not given opportunities to use digital and non-digital technological tools to deepen their learning.
4. There was an apparent support in science, math, and technology pedagogical directives for cooperative learning approaches and a call to reinforce discourse and communication among learners in line with internationally recognized life skills. Nonetheless, the proposed educational

experiences did not engage learners in open-ended, inquiry-based situations that targeted higher order thinking skills such as reasoning and argumentation that would have encouraged students to think reflectively in divergent ways. Furthermore, while the pedagogical directives supported the use Information and Communication Technologies (ICT) to facilitate communication and the social construction of scientific and mathematical knowledge, the proposed activities were not flexible enough to provide inclusive opportunities for employing ICT in information analysis and problem solving by learners.

GENERAL ACTIONABLE RECOMMENDATIONS

The review team recommends that the Ministry of Education **appoint a STEM Committee that guides the revision and implementation of integrated STEM approaches in the curriculum across all school stages and grades.** The committee members should include the different stakeholders involved in the educational process. This could include, but not be limited to school leaders, teachers, curriculum experts, textbook authors, educational researchers, and parents. It is also recommended that the appointees of this committee include participant/reviewers who collaboratively produced the following recommendations. Top priorities for the MOE, Curriculum Directorate, Curriculum developers, and other stakeholders are enumerated as recommendations in Table X. STEM team recommendations are categorized by types of actions needed, the grade levels, and subject areas covered by each enumerated recommendation. While many recommendations could apply more universally, the table highlights grade levels and subjects where specific reforms were identified during the curriculum review. They indicate a gap, missing content area, or other issue identified in the review of materials at that subject area and grade level.

Table 3: STEM Team Recommendations

		Urgent	High priority	Medium priority	Low priority			
		Science	Math	Science	Tech	Math	Integrated STEM	Integrated STEM
Recommendation	Actions Needed	Primary	Primary	Middle	Middle	Middle	Primary	Middle
	Consistency in instructional programming across the curriculum							
#1	Alignment between curriculum guide, teachers' guides, and students' textbooks	x	x	x	x	x		
#2	Apply scope & sequence across subjects	x	x	x	x	x		
	Modify subject-specific content							
#3	Integrate technology	x	x	x	x	x		
#4	Science in society and history	x		x				
#5	Four content domains: Numbers and operations, geometry, probability and data organization/ processing		x			x		
#6	Mathematical discourse/argumentation		x			x		
	Learner-directed problem solving: STEM subjects							
#7	Self-directed inquiry (science, technology)	x		x	x			
#8	Computational thinking (math, technology)		x		x	x		
	Integrated STEM							
#9	Correlated scope & sequence for integrated STEM						x	x
#10	Design (engineering) thinking						x	x
#11	Integrated STEM competences in 21st century society						x	x
	Improve Assessment Methods							
#12	Learner-directed assessment, measuring of/for/as learning, & assessing mastery	x	x	x	x	x	x	x
	Training: Effective STEM methods							
#13	Curriculum Developer (textbook author) training		x		x	x	x	x
#14	Teacher training	x	x		x	x	x	x

Prioritization of Recommendations

All of the recommendations that follow are important, however, the team has endeavored to prioritize those which may are advisable to tackle first. However, priorities are different across STEM subjects, so it is impossible to fully generalize. For example, a priority in math would be to review the textbooks for accuracies in content before aligning with teacher guides – though both are marked "urgent." Additionally, all actions related to modifying subject-specific content should be undertaken first, so that updates can be seamlessly woven into efforts to the transition to an integrated STEM curriculum. This is why the content related recommendations are marked at the subject-level, but not specifically called out in the Integrated STEM columns. Likewise, actions that call for learner-directed problem solving in STEM subjects, encourage greater STEM integration overall, but the recommendation in that area (#8 and #9) are focused at the level of existing STEM subjects. Modifications at the subject level would be in service of greater STEM integration.

Consistency in instructional programming across the curriculum

Throughout the review the alignment between curricular materials (Curriculum Document, i.e. pedagogical directives; teachers' guides; and students' guides) demonstrated gaps and a failure to cascade best practice content and approaches successfully across materials. Additionally, the review team developed subject-specific scope and sequence documents as part of the review process. These documents evidenced the need to apply cohesive scope and sequence documents across subjects. Precise recommendations related to both alignment and scope and sequence are detailed in this section.

1. **Alignment between Curriculum Document, teachers' guide, and students' textbooks.** The Curriculum Directorate should secure a provision for ensuring congruency between the Curriculum Document, teachers' guides as well as students' textbooks. This provision could take the form of a Quality Assurance (QA) committee that includes members from the review team. Much of the content of the Curriculum Document was highly compliant with international best practice, but was missing in teachers' guides and/or student textbooks.

   Coordinate efforts and workshops by the Directorate of Curricula between middle and primary levels curriculum review committees to unify the understanding of reform principles and grounds to ensure the delineation of proper learning progressions and sequencing of topics across math content and cognitive domains from grades 1-9.

   Stakeholders: Curriculum Directorate, QA committee, Assessment and Evaluation Directorate, Inspection and Monitoring Authority, Supreme Educational Council, School Life Directorate, Central Unit for Training and Educational Innovation, General Authority for Statistics and Strategic Planning, Directorate of Private Education.

2. **Apply scope and sequence across subjects.** All stakeholders are encouraged to use the developmental curriculum scope and sequence documents created by the review team to better delineate the progression of concepts from grade to grade. Actions should be taken by the Curriculum Directorate, such as supporting the development of progression documents that include scope and sequence charts – that highlight cognitive difficulties and pedagogical research-based solutions for all subjects across grades 1-9. These tools could be used in teacher preparation and professional development, organizing curriculum, and in writing textbooks. These direct application tools would help to ensure that current gaps are riveted, thus guaranteeing a coherent flow of concepts. The team offers the following guidance for improving alignment across grades in specific STEM subjects – especially at particular levels that arose as more problematic:

Primary and middle level science curricula.

- Addressing matter and its properties in the first year of primary education.
- Restructuring the units of the physical sciences middle school curriculum ensuring sequential progression of concepts within the units of the light, and mechanics.
- Restructuring the units of the life & earth sciences middle school curriculum ensuring that the concepts of 'living organisms and their interaction with the environment' get offered to all grades across the middle school and integrated into 'the reproduction of living organisms and the transmission of genetic traits in humans';
- Including the unit of 'earth & the solar system' across all levels of the middle school.
- Including the unit on 'human health and interaction with the environment' within the middle school curriculum, and revising the sequence of its scientific concepts (physiological functions and body protection).

Middle level math curricula.

- Reformulating learning objectives and competencies at the middle level to ensure extension, continuity, and sequencing of the mathematical concepts according to students' developmental level.
- Going beyond procedural computations of integers and fractions and focusing on problem-solving using contexts inspired from the Moroccan culture;
- Including the topic of probability and basic statistical principles in primary grades 5 and 6 in the context of mathematical games that implicitly provide some basic notions of randomness and chance and establishing extensions in year 1 and 2 of middle school to make the learner develop probabilistic thinking and use it in their life;
- Inclusion of the topic of exponents, equations with one unknown and their operations, and their use in problem-solving related to the learner's real life in the 2nd year of middle school.

Stakeholders: Curriculum Directorate, Curriculum Developers, All Stakeholders

Modify Subject-Specific Content

The review identified content related to specific STEM subjects that should be modified, expanded, or edited for accuracy. The subjects and content modifications are detailed below.

3. **Integrate technology.** The Curriculum Directorate should develop the primary technology component within the science Curriculum Document ensuring that the 'technology project' is addressed in a fashion that simulates that of the middle school which has shown closer matches to international best practice.

   Additionally, at the middle level, the Curriculum Directorate should integrate information and communication technology in mathematics teaching by including specific standards related to technology and proposing activities in the curriculum document, textbooks, and teacher guides. Technology inclusion can be supported by designing online platforms and open access websites for posting digital resources for students and teachers' use. Also, students can be encouraged to use free dynamic geometry software (GeoGebra for example) to deepen understanding of geometric ideas and develop visualization skills.

   It is critical that the MOE ensure that technology is re-offered to grade 7. At present the discontinuity in curriculum offering constitutes a major threat on students' learning of the subject.

Especially at the middle level, integrating technology also requires modifying physical learning spaces so that all learners have access to classroom workspaces able to incorporate technology, which are conducive to collaborative design-based learning.

Specifically the team recommends delegating workshop areas within schools. The practical aspect of the curriculum should be enhanced by securing schools with the resources needed to achieve this. As such the MoE should work towards securing workshop areas within schools conducive for creating designs by students and testing them. (Technology, middle level)

Curriculum Documents should include specific directives related to organizing specialized learning spaces inside and outside the classroom that offer teachers and students flexibility in structure, equipment, and access to materials. This would enhance the practical aspect of the technology curriculum. The MOE should work towards securing workshop areas within schools conducive to creating designs by students and testing them. Flexible learning spaces are adaptable to the learning activity and invite creativity, collaboration, co-discovery, and experimentation in accessible teacher-guided environments [104]. These learning spaces can be enriched and augmented by virtual and technology-based platforms to reinforce learners' STEM experiences. (Technology, middle level)

Stakeholders: MOE, Curriculum Directorate, Curriculum Developers

4. **Contextualize science in society and history**. Incorporate the history of science, science as a human endeavor, global issues such as development of societies, preserving resources, sustainable development and limiting pollution. (science, primary and middle levels)

   Stakeholders: Curriculum Directorate, Curriculum Developers

5. **Four content domains: numbers and operations, geometry, probability and data organization/ processing.** Incorporate content modifications pertaining to the four content domains, Numbers and Operations, Geometry, Probability and Data Organization and Processing that align with best practice models. [105]

   In addition to the content modification suggested below, the content-based timetable for math at the primary level should be revisited. The review team suggests reallocating instructional time across content domains and grades to ensure coherence and rigor. Specifically, increase the time allocated to the field of data processing and organization (up to 20%) across the six primary grades by rebalancing the coverage of contents related to the field of counting and arithmetic according to the time recommended in best practices. Furthermore, recalibrating the time allocated for some grade 5 and 6 lessons, programmed in the last two units, by reconsidering their order and distribution across the six units. Specifically, units that involve a review of prerequisite concepts from previous grades (e.g., units 1 & 2) can be covered in less time than the last two units where lessons require longer time to cover new topics. (math, primary)

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[104] Sanders, M. (2012). Integrative STEM education as best practice. Paper presented at the 7th Biennial International Technology Education Research Conference, Queensland, Australia.

[105] Lindquist, M., Philpot, R., Mullis, I. & Cotter, K. (2019). TIMSS mathematics framework. http://timssandpirls.bc.edu/timss2019/frameworks/framework-chapters/mathematics-framework/

Content at the Primary Level

In the Numbers and Operations domain, include:

- Finding the missing number or operation in a number sentence;
- Defining or writing statements or number sentences to represent the situations of a problem that includes unknowns;
- Defining and using relationships within a specific pattern (for example: describing the relationship between sequence terms and creating pairs of whole numbers (natural integers) according to a rule);
- Demonstrating knowledge of the place value of the natural (whole) decimal integers;
- Representing decimal numbers using words, numbers or patterns;
- Reconsidering naming the natural integers (the whole numbers);
- Making connections between mathematical concepts and with concepts from other subjects in real life contexts. For example, instead of introducing addition and subtraction separately, combining the construction of the two concepts to enable a balanced awareness of the inverse relationship between them.

In Geometry and Measurement, include:

- Linking geometry transformations with their applied geometric uses and constructions;
- Connecting measurement concepts that are not limited to the direct use of operations on measurements in the context of solving real life problems;
- Integrating technology tools in geometry and measurement in relevant lessons;
- Creating two-dimensional compound common shapes (circles, triangles, quadrilaterals, and other polygons);
- Introducing modeling [106] to represent geometric relationships or construction principles (modeling without using geometry tools).

In Data Organization and Processing, include:

- Integrating technology by utilizing multiple visualization tools to describe and represent data based on simple statistical properties [107];
- Employing elementary principles of probability in the context of mathematical games;

Content at the Middle Level

In the Numbers and Operations domain, include:

- finding and using multiples and factors, determining prime numbers and deconstructing a number into the product of prime factors for their multiple uses in the rest of the program components;
- Emphasizing algebraic expressions and incorporating activities that explain the meaning of variables and unknowns and highlighting its algebraic and practical significance;
- Integrating geometric, algebraic and numerical concepts through problem solving and designing activities in the textbooks and teacher's guides that highlight the need to connect math ideas to real life situations;
- Incorporating proofs [108] in geometry and developing students' logical thinking through simple activities that build student capacity to reason logically and to build an argument justifying their thinking;

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[106] Grandgenett, N. F., Ostler, E., Zygielbaum, A, Henniger, S., Hazzard, C. (2000). Mathematical modeling within a technology based learning environment: Some principles for adaptive instruction.

[107] Kelley, T., Knowles, G. (2016). A conceptual framework for integrated STEM education. *International Journal of STEM Education,* 3(11).DOI 10.1186/s40594-016-0046-z

[108] Helena, R. (2019). Mathematical proof: From mathematics to school mathematics. *Phil. Trans. R. Soc.* http://doi.org/10.1098/rsta.2018.0045

- Adding space geometry as an additional topic and highlighting its importance in the curriculum document, textbooks, and teacher's guide. Such inclusion can be supported by specific models and methods through which students build an understanding of three-dimensional geometric figures, and engage in designing models to represent its characteristics;
- Introducing probability and focusing on the functional aspect of statistics by providing sequenced activities starting from how data are collected to interpreting results; and using these skills in situations and activities to solve real life problems related to the field and that is meaningful to the learner.

Stakeholders: Curriculum Directorate, Curriculum Directorate: responsible for timetables, Curriculum Developers

6. **Mathematical discourse/argumentation.** Conduct a comprehensive review of ALL textbooks and teacher guides from grades 1-6 to ensure mathematical accuracy across all content. The prevalence of major conceptual errors as well as the lack of clarity, accuracy, and appropriateness of topic presentation reported in most textbooks under review can impede student success in learning quality content. Therefore, the reviewers highly recommend an examination of mathematical vocabulary, [109] unifying it and aligning it with the approved conceptual framework described in the curriculum document, as well as reinforcing the teacher guides with accurate practical directives that explain and clarify the guidelines and principles underlined in the curriculum document, providing the scientific ground for a purposeful implementation in the classroom. Those involved with developing mathematics textbooks and related instructional materials need to engage mathematicians, as well as mathematics educators, at all stages of writing, editing, and reviewing these materials.

   Stakeholders: Curriculum Directorate, QA committee – inclusive of mathematicians and math educators, Curriculum Developers

Learner-Directed Problem Solving for STEM Subjects

STEM subjects, specifically those already present in the curriculum across all grade levels, grades 1-9, (i.e. math, science) should include more opportunities for learner-directed problem solving that incorporates technology to a greater extent. Suggestions for incorporating science and technology for leader-based inquiry and math and technology for computational thinking are elaborated below.

7. **Self-directed inquiry.** Ensure that students across grade levels not only practice doing inquiry in science and technology, but that they also create their own scientific investigations based on problems springing from daily-life experiences. Maintain opportunities in student textbooks and refrain from converting them into instances where students apply experiments rather than develop and execute them in order to foster opportunities to use higher order thinking skills or advanced research skills (at the middle level). (science and technology, primary and middle levels)

   Stakeholders: Curriculum Developers

[109] Wood, M. B., Turner, E. E., Civil, M., & Eli, J. A. (Eds.). (2016). Proceedings of the 38th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education. Tucson, AZ: The University of Arizona

8. **Computational thinking and problem solving.** Centralizing computational thinking as a cross-cutting skill from grades 1-9 and providing supporting multidisciplinary activities and projects integrating technology and the use of modeling software to diversify math representations.

   Expanding the principle of using mathematical representations in the Curriculum document to include multiple modalities and translations between modalities to facilitate problem solving. [110] And, incorporate elementary concepts of computational thinking and algorithmic modeling to solve real problems by including activities that integrates technology and science using modeling. [111]

   Align middle and primary school curriculum in adopting the problem situation as a starting point for building mathematical concepts in harmony with the competency-based approach. [112]

   Reinforce textbooks and teacher guides at the middle school level with culturally relevant pedagogy [113] inspired by the Moroccan context and diversifying activities that engages higher order cognitive skills and problem solving that support the development of 21st Century skills. [114]

   Integrating computational thinking skills as cross-cutting competences in science, math and technology and specifying technology-specific learning objectives integrated in parallel between mathematics and science classes. The conceptual overlap between computational thinking and engineering makes engineering a suitable disciplinary context to engage students in computational thinking. [115] (math and technology, primary and middle levels)

   Stakeholders: Curriculum Directorate

Integrated STEM

The following recommendations are intended to shift the curriculum from subject-specific STEM approaches and content, to a curriculum more closely aligned to integrated STEM international best practices. While suggestions can be introduced through specific subject, such as design thinking, which could, for example, be introduced in a primary level (and subsequent revised middle level technology curriculum), the team advises towards integrated, cross-subject approaches to incorporating the following key content, context, and methods.

9. **STEM integration.** Introducing a statement in the **curriculum documents** to endorse and support the integration of contexts and standards in the science and mathematics curricula and technology projects. Therefore, reviewers recommend that curricular emphasis shift from organizing instruction around the formal structure of subjects to focusing on a sequence of activities that guide students through the integrated use of knowledge. [116] As well as explaining

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[110] Pape, S., & Tchoshanov, M. (2001). The role of representation(s) in developing mathematical understanding. *Theory Into Practice, 40*(2), 118-127. http://www.jstor.org/stable/1477273

[111] Cansu, S., & Cansu, F. (2019). An overview of computational thinking. International Journal of Computer Science Education in Schools 3(1). DOI: 10.21585/ijcses.v3i1.53

[112] Soare, E. (2015). The 6th International. Perspectives on designing the competence based curriculum. Procedia - Social and Behavioral Sciences, 180, 972 – 977.

[113] Ukpokodu, O. (2011). How do I teach mathematics in a culturally responsive way?: Identifying empowering teaching practices. *Multicultural Education, 19*, 47-56.

[114] OECD(2018). PISA 2021 Mathematics Framework

[115] Shute, V. J., Sun, C., & Asbell-Clarke, J. (2017). Demystifying computational thinking. *Educational Research Review,22,* 142–158.

[116] Herschbach, D. R. (2009). *Technology education foundations and perspectives.* Homewood, IL: American Technical Publishers.

the concept of integrated STEM learning and highlighting its importance at the primary and middle school levels. [117]

Stipulation by mathematics, science and technology curricula review committees, in pedagogical directives, to adopt the correlated curriculum [118] approach that facilitates gradual transition towards integrated STEM education. This approach is synchronized with the ongoing instructional programs while paving the way to inclusion of integrated and unified digital and technological projects in science and mathematics. What is required, however, is coordination and planning among the different stand-alone subjects, and a clarification of the intersections between these subjects by harmonizing the use of scientific practices and mathematical language in teaching across subjects.

Reorganizing the instructional programming and sequencing of units in science and mathematics to support integration within a coherent coordination framework. For example, reorganizing the mathematics topics across the six grades by reorganizing some lessons related to the field of data processing or measurement, in order to align them with opportunities to harness the science lessons.

Relatedly, the team recommends revisiting the timetable for lessons in order to avoid scheduling data-related activities within the last lesson in all middle school grades. Attaching greater importance to the investigative approach in science, technology and mathematics pedagogical directives by the QA Committee, by reorganizing the contents to allow sufficient time for effective investigation by learners.

Coordination between the competencies and contexts of mathematics, science and technology subjects to prepare pedagogical directives that ensure the interconnection and complementarity of these subjects in supporting joint projects related to STEM specializations. This coordination can be operationalized by drawing up terms of specifications to direct textbook authors to incorporate course units in parallel with projects that integrate science, mathematics and engineering design. This project-based approach to learning must take into account the age of learners, mobilizing their prior knowledge in math and science and developing their ability to be innovative through experimentation, modeling, managing variables, accurate observation and analogy, in addition to being able to use critical and creative thinking.

Strengthening STEM integration in textbooks and providing directives for authors of textbooks and teacher guides to incorporate inclusive themes or contexts that integrate multiple subjects (multi-disciplinary) as well as technology projects on a regular basis. [119] Moreover, infusing student assignments with learning activities that require cooperation and collaborations between learners to be conducted in specific time periods and that require learners to integrate their STEM achievements, by implementing technological projects based on employing engineering modeling and building solutions to real problems aligned with the integrated STEM learning approach. [120] (Integrated STEM, primary and middle levels)

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117 Walker, W., Moore, T.J., Guzey, S., Sorge, B. (2018). Framework to develop integrated STEM curricula. K-12 STEM Education, 14(2), 331-339

118 Greene, S. (2014). STEM education: How to train 21st century teachers. Nova Publisher.

119 Vasquez, A., Comer, M., Sneider, C. (2013). STEM Lesson essentials: Integrating science, technology, engineering, and mathematics.

120 Kelley, T., Knowles, G. (2016). A conceptual framework for integrated STEM education. *International Journal of STEM*

Stakeholders: Curriculum Directorate, Curricula developers

10. **Design thinking/ engineering design skills.** The stipulation to adopt engineering design skills in conjunction with technology projects, which would bring forth suitable challenges that would enable a seamless integration and applications across different subjects and provide a context for advanced problem solving. Integration of design skills could be incorporated within a designated progression timeline and growth corresponding to students' developmental levels across the grades.

    The team recommends that clear directives by the QA Committee regarding the integration of engineering design and computational thinking skills in collaborative projects be included at the end of each educational unit. The projects require students to take meaningful decisions to justify the design, to draft reports, and to set forth explanations about the basic rules adopted by the groups, with the possibility of reviewing and re-working the approved designs. This stipulation also requires that specifications directing textbook authors and teacher guides to insert activities that give the learner opportunities for cooperative work on projects that incorporate engineering design activities and computational thinking skills [121] giving students opportunities to reflect, implement and evaluate non-directed engineering design steps based on standards such as safety, risks, ethical and environmental considerations.
    Technological design thinking is consistently the core technology dimension of the science, math, and technology curriculum across levels, starting grade 1. This should be coupled with opportunities for students to test and re-test their designs, making sure they understand the science-technology-society relationship. For example, in grades 1 and 2, students are introduced to engineering design through projects directed entirely toward ensuring familiarity with design approaches.

    At the middle level students should be given the chances to explore the impact of new and emerging technologies on industry, enterprise, sustainability, people, culture, society and the environment, production techniques and systems. They should be given the opportunities to examine how the critical evaluation of new and emerging technologies inform design decisions; considering contemporary and potential future scenarios from different perspectives, such the environment. For example, in grades 3 and 4, students engage in problem-based learning through semi-directed projects that facilitate transition towards using engineering thinking and design skills in grades 5 and 6, which can further extend to middle school via expansions to more unguided projects. (STEM subjects: math, science, and technology; primary level)

    Stakeholders: Curriculum Directorate, QA Committee, Curriculum Developers

11. **Integrated STEM competencies in 21st Century society.** Stipulating the use of quotas for the development of life skills and 21st century competencies would allow systematic and explicit support for the principles of communication, cooperation, responsibility, flexibility and problem-solving. It would also support investments in national projects related to revitalizing school life,

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Education, 3(11). DOI 10.1186/s40594-016-0046-z.

[121] Weintrop, D., Beheshti, E., Horn, M., Orton, K. (2016). Defining computational thinking for mathematics and science classrooms. *Journal of Science Education and Technology, 25*, 127-147.

such as the professions discovery project and the financial education project [122] as carrier projects to concretize STEM integration, promoting its modules and activities by introducing the specializations offered by STEM, so that learners would become familiar with the work of specialists in these areas.

Additionally, building awareness of STEM-related fields by including explicit directives in the curriculum document introducing the learner to relatable STEM role models, particularly women in STEM, such as Moroccan professionals from a wide range of STEM careers. Encouraging collaborative and networked STEM communities of practice [123] connecting schools to community resources such as science museums, libraries, industries that draw on the knowledge, tools, resources, and expertise needed to effectively engage in STEM teaching and life-long learning experiences, in and outside of formal school settings would also develop awareness and interest in STEM subjects.

Finally, inclusion of explicit stipulations in pedagogical directives, textbooks, and teacher's guides on adopting projects and activities that enable the learner to assume their responsibility in teamwork, and express their ideas by employing ICT resources that support the development of 21st century competencies [124] should be encouraged. Furthermore, drawing up terms of specifications that direct textbooks and teacher guides' authors to include diverse educational learning activities that link science, technology and mathematics to the Moroccan context and promote opportunities for culturally relevant pedagogies [125] by facilitating new modes of exploring STEM concepts and skills. (Integrated STEM, primary and middle level)
Stakeholders: MOE, Curriculum Directorate, Curriculum Directorate: responsible for timetables, Assessment and Evaluation Directorate, Curriculum Developers, Inspectors, Teachers, Parents

Improve Assessment Methods
Recommendations would be incomplete without a recommendation to ensure that suggested changes in STEM subjects and shifts toward an integrated STEM curriculum across subjects require revisiting best practice assessments.

12. **Learner-directed assessment.** Provide opportunities for students to carryout peer and self-assessments. At the middle level, a major addition to the curriculum should be 'reflective practice' opportunities that would ensure that students learn effectively.

    Assessing of/for/as learning. Additions to the curriculum should be made by to leverage assessment opportunities to better cater for assessment of/for/as learning. (see: Q2 science findings for definition of learning types).

    Diverse tools to assess mastery of concepts. Competency-based curricula are established on the principles of personalized and mastery learning, hence assessment of learning should be conducted using diverse and authentic assessment tools such as performance and formative

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[122] A National Project, targeting grades 5 & 6 that was launched by Al- Jahwiyah Academy for Educational Training in Casablanca in 2017.
[123] US Department of Education (2016). STEM 2026: A vision for innovation in STEM Education. Office of Innovation and Improvement.
[124] OECD (2019). PISA 2021 Framework.
[125] Ukpokodu, O. (2011). How do I teach mathematics in a culturally responsive way?: Identifying empowering teaching practices. *Multicultural Education, 19*, 47-56.

assessments, short investigations, open-response questions, portfolios, collaborative projects, and dynamic assessments involving "think alouds."

Stakeholders: Curriculum Directorate, Curriculum Developers

Training: Effective STEM Methods

Curricular changes will require training to be implemented as recommended. In particular, the team recommends working closely with curriculum developers and teachers in the areas indicated below.

13. **Curriculum Developer (textbook author) training.** Supervising the authoring teams to build a deeper and broader understanding of content and pedagogical specifications contained in the curriculum document by going beyond the fragmented implementation of the learning objectives and promoting the synthesis and integration of activities in textbooks and teacher's guides. In mathematics, reviewers further propose a verification by the authoring committees of the Didactic directives in the teacher's guides accompanying the learner's activities to focus on using mathematical discourse [126] metacognitive strategies and cognitive skills in alignment with the learning objectives, in addition to highlighting the cognitive levels and mental skills targeted by each of the proposed activities in the textbook and supporting material. (math, primary). Reviewers further recommend adherence to the recommendations of the pedagogical directives of the curriculum document by textbook authors through the preparation of accurate and detailed terms of specifications for teacher implementation and to diversify resources for teaching (not only limited to the textbook). (math, middle)

    Reviewers proposed that to strive for greater STEM integration authors and education resources' designers are oriented to perform the following:

    a) Proposing real and motivating problem situations that immerse the learner in real opportunities to design technology projects by incorporating engineering design approach, such as starting with a problem or need that leads to an engineering solution, using patterns and simulations, building design-based solutions, reviewing and checking solutions.
    b) Incorporating the use of computational thinking skills within science and math subjects to formulate, solve problems, conduct inference abstractly and quantitatively and use appropriate tools accurately and regularly.
    c) Enhancing, enriching or reformulating the contexts of investigative situations included in the learners' textbooks to provide real challenges that encourage evidence-based discussion, collaboration and dialogue in both science and mathematics.
    d) Integrating mathematics in science and technology, for example, by combining engineering and mathematical operations in the areas of electricity, building the electrical circuit and its various components, employing calculations in the subject of nutrition and calculating calorie yield in meals. Other examples include, using data visualization tools to understand biological or climatic phenomena (the evolution of temperature, atmospheric pressure, rainfall evolution and its relationship to agricultural including livestock production, etc.).
    e) Producing interactive and dynamic hypermedia resources and simulation tools to demonstrate scientific experiments and to highlight incorporated scientific practices that support and supplement the learner's textbook activities.

    Stakeholders: MOE, Curriculum Directorate, Curriculum Developers

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[126] Hufferd-Ackles, K., Fuson, K. C., & Sherin, M. G. (2004). Describing levels and components of a math-talk learning community. *Journal for Research in Mathematics Education, 35*(2), 81–116.

14. **Teacher training.** In middle level mathematics, the review team recommends holding ongoing professional development workshops to train teachers in three fundamental areas: 1) designing instructional strategies to support learning at different cognitive levels, 2) integrating technology and using web digital resources to support the teaching and learning of math concepts and skills, and 3) applying a range of diverse learning assessment strategies and effective performance measurement tools to enhance their teaching practice. Additionally, in primary mathematics, reviewers recommend an examination of international best practices in terms of proposed breadth and depth of math content, cognitive levels and teaching strategies that must crystallize in order to implement the directives in the curriculum standards and to support the learners' mastery of quality knowledge, skills and dispositions. (math, primary and secondary level)
15.
    In technology teaching, across grades 1-9, the MoE should ensure sufficient preparation and continuous training for teachers involved in the delivery of technology curriculum. It should also allocate resources for the effective teaching of this curriculum. Preparation and development of a project by the relevant departments at central, regional, prefectural, and local level, with the participation of pedagogical primary education inspectors and technology inspectors, aimed at teacher development, with a view to implementing integrated STEM approaches. (technology, primary and secondary level)

    Stakeholders: MOE, Curriculum Directorate, Regional Academies, Inspectors, Teachers

TASK 2 – INCLUSION AND ACCESSIBILITY

ANALYSIS OF MOROCCAN TEACHING AND LEARNING MATERIALS FOR ACCESSIBILITY AND INCLUSION

BACKGROUND

In 2019, the MOE mandated seven contracted publishers to review all textbooks to ensure that they comply with the new curriculum specifications. These textbooks were also scrutinized by the MOE Ethics Committee and were expected to be fully accessible and inclusive. However, an informal revision carried out by USAID's National Program for Reading (NPR) showed that the textbooks and teacher guides related to them are still not fully aligned with the basic requirements of accessibility and inclusivity as indicated by UDL standards, the principles and practices for multicultural education and gender, and international guidance on accommodations and adaptations for students with disabilities. Hence, USAID supported this thorough analysis of these textbooks and guides for Grades 1 to 6 in partnership with the relevant MOE staff. The context and analysis of curricular materials for inclusiveness and accessibilities are detailed in this section of the CCA report.

SITUATION OF INCLUSIVE AND ACCESSIBLE EDUCATION IN MOROCCO

The Government of Morocco (GoM) considers the rights of people with special needs and those with disabilities a priority in developing social, educational, and other policies that promote equal opportunity and participation of those groups of people in all aspects of human activity. Based on Morocco's Constitution, people with disabilities must be offered the necessary support systems to enjoy the rights and freedoms recognized to all citizens of the Kingdom.

> *"The public powers develop and implement the policies designed for persons and for categories of people with specific needs. To this effect, it shall seem notably to:*
> - *Address and prevent the precarious conditions of certain categories of women, mothers, children, and elderly people;*
> - *Rehabilitate and integrate into social and civil life people suffering from a physical, sensory motor and mental disabilities and allow them to enjoy the rights and freedoms recognized to all." (Article 34 of the Constitution of the Kingdom)*

Inclusive education is "*the most effective way to give all children a fair chance to go to school, learn, and develop the skills they need to thrive.*" [127] This approach requires that all children be in the same schools and the same classrooms while provided the same educational opportunities with children without disabilities and the contributions of all students those with disabilities as well as those who are culturally and linguistically diverse and come from backgrounds and historically have been excluded from educational and career opportunities are being valued and celebrated. [128]

Educational Policy Background and Context in Morocco

As a foundational right, education paves the road to individuals' abilities to lead meaningful, independent, and fulfilling personal, social, and economic lives. Since the late 1990s, the Government of Morocco (GoM) developed integrated policies that can be translated into educational programs and has taken several actions including training of education ministry officials, teachers, inspectors, and curriculum developers on best practices for inclusive education. Morocco's MOE has launched multiple projects and activities to improve the education of learners with disabilities in the country and has instituted Inclusive Education (IE) for all as one of its major goals within the Framework of the Strategic Vision of the Reform 2015-2030.

In a policy document titled *Frame of Reference of Inclusive Education for Children with Disabilities* (FRIECD), the Moroccan MOE outlines the importance of the professionalization of the teaching profession and its impact on delivering pedagogically appropriate instruction and assessment for all children to meet their individual learning and socio-emotional needs. In addition, MOE emphasizes the importance of inclusive education and its principles as the vehicle for giving the opportunity to all children to enjoy the right to free, appropriate, public, and non-discriminatory education.

The Moroccan MOE views inclusive education as a community project with all the relevant actors and stakeholders involved because 'Education as a 'System' is woven into all aspects of human life and activity and is an integral component of a nation's endeavors towards progress and prosperity. Gouleta, Witte, and Letiecq [129] stress that in attempting any type of educational reform, working with communities and education stakeholders, children, teachers, researchers, and families drawing in all students - including those who are culturally and linguistically diverse and those with special needs and disabilities is important.

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[127] UNICEF. (2020). Op. cit.,
[128] UNICEF. (2020). Op. Cit.
[129] Gouleta, E., Witte, J., & Letiecq, B. (2015). Using digital technology and a community-based approach to improve educational outcomes for culturally, linguistically, diverse, and exceptional children in Pakistan: A conceptual framework. Journal of Asian Development Studies, Volume 4 (1), pp. 50-66.

By making inclusive education a *community matter*, the Moroccan MOE offers the opportunity and draws the pathway to move from the "medical model" [130] for disability to one that is free of bias, discrimination, and stigmatization making disability and the inclusion of all learners into the educational system everybody's concern. By shifting the focus from the "medical model" to inclusivity, MOE supports the shift from focusing on the disability to celebrating the contributions of each member of the society to the school, classroom, and to the educational process as invaluable.

General Philosophy and Basic Principles of the Moroccan Frame of Reference of Inclusive Education for Children with Disabilities for Inclusive Education

Under its human development plans, the GoM developed a frame of reference for teaching children with disabilities according to the principles of the 2011 Constitution of the country. This educational framework is based on the philosophy that children with disabilities in Morocco will be provided context appropriate educational support systems so that they "will enjoy the right to a schooling that is open to the prospects of educational, social and economic integration" through the necessary pedagogical processes that are child-centric and are based on each individual learner's needs. [131]

The framework is based on three basic premises:
"(a) the status of schooling of disabled children, the experiences, the potentialities and the shortcomings accumulated in this field;
(b) human rights, legislative and educational references that relate to the architecture of learning and educational methodologies at the Moroccan school, or Morocco's legal arsenal of laws, policies, and legislative texts; and
(c) international experiences in inclusive education-related learning architecture, and the various scientific studies that attempted to lay down concepts and approaches to school curricula and contents specific to teaching children with disabilities" [132]

Current Situation of Teaching Children with Disabilities in Morocco

The Moroccan MOE's strategy includes participation and study in integration classes and the official curricula for children who have mild, moderate, or sensory disabilities since the 1997/1998 school year. This integration involved the adaptation of educational content, methodologies and techniques while focusing on individual learners' needs. That experience led to a set of conclusions which enabled the MOE to understand the situation and further develop practices for teaching children with disabilities in the inclusive classrooms.

It was found that there was a need for standardization of the use of terms and concepts related to disability, to develop a national approach to inclusion, to give priority to inclusive education practiced in holistic and research-based ways, to mobilize and sensitize the communities on disability issues, to provide tailored instruction according to the needs in the inclusive classrooms, and tools (pedagogical and material) for accessibility and individualized learning.

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[130] The medical model of disability views disability as a 'problem' that belongs to the disabled individual. It is not seen as an issue to concern anyone other than the individual affected. For example, if a wheelchair using student is unable to get into a building because of some steps, the medical model would suggest that this is because of the wheelchair, rather than the steps. The social model of disability, in contrast, would see the steps as the disabling barrier. This model draws on the idea that it is society that disables people, through designing everything to meet the needs of the majority of people who are not disabled. There is a recognition within the social model that there is a great deal that society can do to reduce, and ultimately remove, some of these disabling barriers, and that this task is the responsibility of society, rather than the disabled person. Source: https://www2.le.ac.uk/offices/accessability/staff/accessabilitytutors/information-for-accessability-tutors/the-social-and-medical-model-of-disability

[131] Government of Morocco (2019). Frame of Reference of Inclusive Education for Children with Disabilities (FRIECD). pg. 8.

[132] Ibid.

It was also found that the number of students with disabilities ranged between four and 20 per classroom and that there was variability regarding schooling time, with some instructors following differentiation of instruction strategies while others needed additional training to apply the methods of instruction correctly. [133] Therefore, there was not a systematic approach with equal access to school integration and attendance. In addition, the learning contents, processes, and products were not always differentiated, a fact that made it exceedingly difficult for all children with disabilities to enjoy equal opportunities for schooling, and therefore learning. The inspectors, teachers, and educational professionals needed quality and continuous training on disability and a multidisciplinary team comprised of educators, administrators, medical and paramedical professional, families, civil society organizations, and other stakeholders was found to be important so that coordinated efforts to achieve the right pedagogical approaches for each child could be developed. [134]

To meet the needs of teachers and learners, a sustainable development plan within the vision 2015-2030 strategy was adopted to close the gaps and develop a systematic, nationwide approach to educational inclusion. [135] This plan is based on the fundamentals of inclusive education and the components of a curricular architecture which take into consideration that an inclusive education strategy follows a social and cognitive constructivism approach to learning. This means that the curriculum is designed with content learning objectives and goals, that the teaching and learning strategies and pedagogical approaches are differentiated - as well as the instructional processes, and that student learning outcomes, including student evaluation, include the necessary adaptations and modifications.

Types of Disability and Educational Adaptations

Inclusivity in education requires an in-depth understanding of the concepts of disability and special abilities and the diverse types of disabilities. This way, schooling and learning can be adapted and modified accordingly so that all children can successfully develop the targeted educational competencies while they are supported in their learning. The categories of disabilities included in the Moroccan inclusive education framework are: "Autism spectrum disorders, *Mental disabilities, Cerebral palsy, Hearing disabilities, Visual disabilities, and Learning disabilities*. For a successful approach to inclusion several elements are considered important: *definition of the disability type, distinctive characteristics of each disability, basic needs of each type of disability, supportive learning needed by each category, and recommended pedagogical practices for each disability*." [136] The inclusive education framework also defines the principles that pedagogical work should follow. These are:

- linkage with the development and learning specificities of a disabled child, based on each type of disability;
- building on the same psycho-pedagogical principles of the public education curriculum, while adapting it as required by the specificities of this category of children;
- adoption of the same organizational and pedagogical procedures governing all mainstream school classes, including all different aspects of school life and related activities; and
- adoption of the same pedagogical inputs of the official educational curriculum, in particular competency-based teaching.

The above principles indicate how pedagogical work should be practiced in the inclusive classroom. Although they address several important issues, they do not give specifics but are rather general. For example, there is no mention about the principle of the Least Restrictive Environment (LRE) which states that the right placement of a child with a disability must be decided according to the needs of the

[133] Ibid. pg. 11.
[134] Ibid. pg. 11.
[135] Ibid. pg. 14.
[136] Ibid. pg. 42.

child and sometimes, depending on the disability, this cannot be the general education classroom (for example, a child with medical issues that require home-schooling or even schooling in a hospital or children with certain emotional disabilities that require small group instruction and a larger number of students in the classroom is not indicated for their proper instruction). [137]

Inclusive Education beyond Disability

Inclusion is not just a pedagogical or human rights approach to teaching children with disabilities. Inclusion is a philosophy, and it extends beyond the concept of disability. In education, **inclusion means the integration of gender, socio-economic, cultural, linguistic, and other differences that the diversity of the student body brings in every classroom.** It is important -while moving away from the medical model on disability- to adopt a holistic approach to inclusion and to bear in mind that a student may present various types of diversities and differences that require attention in the integrated classroom.

For example, a student may have a disability or more than one type of disability, may be gifted and talented in a particular area of the curriculum, may live in poverty, come from a home in which the mother tongue is different from the language of instruction, and may be a girl living in a remote rural area with specific cultural norms. Therefore, it is particularly important to first ensure that within the educational intervention plan of this student all her differences and needs are considered, and the focus of the learning plan does not include only the disability status. Second, the educational professionals and paraprofessionals who serve this student must acquire the necessary knowledge to avoid overdiagnosis, underdiagnosis, or misdiagnosis of this student's special needs. Third, to best serve this student with her diverse and unique set of individual needs: educators, administrators, and inspectors must be able to develop educational intervention protocols that are appropriate and effective. Inclusive education beyond disability, is an ongoing process in Morocco and globally. It requires awareness as well as research-based knowledge and tools to develop and refine related policies and practices.

GOAL

The goal of this activity is to help build MOE staff capacity to use evidence-based curriculum review techniques based on international standards for teaching and learning practices to ensure that curriculum materials across all subjects at the primary level align with the UDL framework and promote equity and inclusion of marginalized populations. This analysis was designed to ensure that textbooks, teacher guides, student assessments, and learning material revisions conducted in the future will adhere to the national and international standards of accessibility and inclusivity. This work has been undertaken by Task Team 2 and concludes by recommending needed modifications and adaptations to meet international standards for accessibility and inclusion and a toolkit of accessibility and inclusion resources and safeguards that need to be taken into consideration in the design and authoring of new materials in the future (Annex 2).

GUIDING QUESTIONS

The following guiding questions and resources aided the review process:

Q1 – In the curriculum for primary grades (1 through 6), how do the TLMs; that is, the learning/teaching strategies, learning content, activities, assessment, etc., align with the UDL framework?

Q1a. How do the TLMs align with UDL principle: Multiple modes of presentation?

[137] IDEA45, Section 300.114, Retrieved from: https://sites.ed.gov/idea/regs/b/b/300.114.

Q1b. How do the TLMs align with UDL principle: Multiple modes of expression?

Q1c. How do the TLMs align with UDL principle: Multiple methods of engagement?

Q2 – In the curriculum for primary grades (1-6), how do the TLMs promote equity and inclusion for all students considering the diversity of the Moroccan student population (i.e., students with disabilities, female students, ethnic and cultural minorities, second language learners)?

Q2a. How do TLMs align with the principles and practices of multicultural education?

Q2b. How do the TLMs align with equity and equality principles for gender and disability?

INCLUSIVITY AND ACCESSIBILITY CURRICULUM REVIEW DESIGN AND METHODS

Guiding question 1. Assessing the alignment between the curriculum and the UDL framework was one of the primary goals of this curriculum review. UDL has been known as an effective curriculum framework to promote accessibility and inclusiveness of the curriculum, where the design of the curriculum considers the diverse needs of students, and accessible knowledge and pedagogies are, accordingly, adopted. [138] UDL, consequently, implements accessible learning and teaching methods in three main domains – which came to be known as the UDL three principles: the means through which knowledge/information is presented, the means through which students express learning, and the means through which students engage with learning. To meet the diverse needs and characteristics of students, UDL essentially calls for the curriculum to include multiple modes and means in the design of each of these three building blocks of learning.

Subsequently, and to help examine the alignment between the curriculum and UDL, the first overarching question was divided into three sub-questions reflecting the three UDL principles:
Q1 a. How do the TLMs align with UDL principle: Multiple modes of presentation?
Q1 b. How do the TLMs align with UDL principle: Multiple modes of expression?
Q1 c. How do the TLMs align with UDL principle: Multiple methods of engagement?

To answer these three sub-questions, the review team developed the UDLCA rubric; a purposefully designed tool that facilitated the review of the different curriculum TLMs across the different school subjects and grades. This rubric included three sections – in line with the UDL three principles: multiple modes of representations, multiple modes of expression and multiple modes of engagement. The development of the UDLCA was based on reviewing the literature on UDL, where indicators on UDL-based curriculum were identified for each of the three UDL principles and framed in 18 statements that assess the extent to which the curriculum align with those indicators on a four-point Likert scale. The design of the UDLCA rubric also allowed for the collection of qualitative data that allowed the curriculum reviewers to provide examples and comments against each of the rubric statements.

The review of curriculum included student textbooks and teacher guides in four school subjects; Arabic language, French Language, Math and Science in grades 1-6, and within each subject, unit two and five were selected as a sample to conduct this review. In addition to these materials, other important documents such as the Education Directives 2020 and the Frame of Reference for Inclusive Education 2019 were also considered in this review activity in order to provide a more comprehensive assessment of the curriculum and its alignment with UDL framework.

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[138] Rose, D. H., Harbour, W. S., Johnston, C. S., Daley, S. G., & Abarbanell, L. (2006). Universal Rose, D. H., Harbour.

Guiding Question 2. The aim of the second guiding question required an examination of whether the curriculum in terms of content, design and pedagogical approaches was inclusive of all learners; including those of diverse socio-cultural backgrounds, gender and abilities. Inclusive education is widely seen as a curriculum framework that promotes equal and equity opportunities to all learners, and takes, in its design and delivery, their diverse backgrounds, characteristics, abilities and needs. [139] This is achieved through removing barriers to learning, which will improve all learners' access to and participation in quality educational services. The increasing call for inclusive curriculum stems from the concern that some groups of students are at risk of exclusion due to their demographic, socio-cultural, language, gender, or ability characteristics. [140] This concern has steered wide efforts among international organizations and researchers to identify the barriers to education and examine the different educational practices that would minimize them. Research on multicultural, gender and disability education has provided both governments and educators with key indicators that they can use in assessing the inclusivity and accessibility of the curriculum and the practices that could, if implemented effectively, achieve equity and equality for all learners.

In this part of the curriculum review, the assessment of the inclusivity and accessibility of the curriculum focused on examining its alignment with the principles of multicultural, gender and disability education. Consequently, and to facilitate the review process, the overarching question was divided into three sub-questions (gender and disability were originally combined as a single sub-question):

- Q2a. How do the TLMs align with the principles and practices of multicultural education?
- Q2b. How do the TLMs align with equality principles for gender?
- Q2c. How do the TLMs align with equity and equality principles for disability?

To answer these three sub-questions, the review team developed the Equity and Diversity Review Rubric (EDR). This tool was purposefully designed to assist the review of the selected TLMs across the different school subject and grades. The EDR rubric includes three sections that correspond to the above three sub-questions, which examine the alignment of the curriculum TLMs with principles of multicultural, gender, and disability education. The EDR rubric was developed by reviewing the literature on these three areas and then identifying a set of indicators that were framed in 16 statements that assess the curriculum alignment with each of these three areas on a 4- point Likert scale. The design of the EDR rubric allowed also for the collection of qualitative data, which enabled the curriculum reviewers to provide examples and comments against each of the rubric statements.

The review of curriculum included student textbooks and teacher guides in four school subjects; Arabic language, French Language, Math and Science in grades 1-6, with exclusive focus on units two and five within each subject as a sample on which to conduct this review. In addition to these materials, other important documents such as the Education Directives 2020 and the Framework on Inclusive Education 2019 were also considered in addressing these questions in order to provide a more comprehensive assessment of the alignment between the curriculum and principles of multicultural, gender and disability education.

TASK 2 – INCLUSIVE AND ACCESSIBLE EDUCATION FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

This section presents the key findings, conclusions, and recommendations from the review of the curriculum materials in primary grades, which was conducted to answer two guiding questions, listed at

[139] UNESCO (2017)
[140] UNESCO (2016).

the start of the Task Team 2 section. Both questions were divided into sub-questions to facilitate the review process and the examination of the different aspects within each question. The questions and sub-questions are presented with findings and conclusions. A set of actionable recommendations are outlined at the end of this section.

QUESTION 1

In the curriculum for primary grades (1 through 6), how do the Teaching and Learning Materials (TLMs); that is, the learning/teaching strategies, learning content, activities, assessment, etc., align with the Universal Design for Learning (UDL) framework?
The following three sections feature the findings for each of the three sub-questions reflecting the three UDL principles.

FINDINGS

Q1a: How do the TLMs align with UDL principle: Multiple modes of presentation?
Findings to answer this sub-question were based on the data collected using the section on "Multiple Modes of Presentation" in the UDLAC rubric - which comprised five statements assessing the alignment of the curriculum with this UDL principle. In other words, this sub-question examines the extent to which the curriculum's design and pedagogical approaches present curriculum content using different modes of presentation such as; visual (pictures, visual organizers, color coded information, graphs, videos), auditory (i.e., recordings, audiobooks, films), hands-on experience (i.e., experiments, field trips, real-life experience), etc.

Findings from reviewing the curriculum teaching and learning materials (student textbooks and teacher guides) show that the curriculum, to a large extent, utilizes one mode of representation - the visual mode, over the other modes such as auditory and hands-on experiences. This was evident in the student textbooks and teacher guides, where pictures are commonly used across the reviewed learning units to support the presentation of the curriculum content. For instance, unit two in the third grade Arabic Language Textbook *Murshidi fi Allouggha Al Arabia*, unit five in the French Language Textbook *mes apprentissages*, and unit five in the teacher guide for sixth grade *Fada' Annashat Al ilmi* all exclusively feature pictures – without any other modes of representation.

The use of the other modes of representation; for example, auditory modes, was very limited in all reviewed subjects, especially in the language subjects (Arabic and French), which, given that they center on language acquisition, one would expect to be highly reliant on different auditory means of presentations (recordings, audiobooks, videos) to facilitate the delivery of the different language content. Furthermore, findings showed an almost full absence of bodily/kinesthetic modes such as hands-on activities, real life experiences, experiments, and field trips in the student textbooks. Exceptions were found in the language subjects, such as in the French language textbook *mes apprentissages* for third and sixth grades, and unit two in the science textbook and teacher guide *Fadaa' Annashat Al ilmi* for sixth-grade (experiment and direct observation of an anatomy of a real sheep brain, page 99 in the teacher guide).

Findings also showed that even though the new Educational Directives from July 2020 include a variety of presentation modes and leverage digital resources (i.e., taleem.ma and tilmidetice.ma), [141] the pedagogical approaches that appear in the lesson planning and design sections of the teacher guides (i.e. lesson-plan cards) rely on visual presentation modes (i.e. pictures) in student textbooks to support the

[141] see for example the Educational Directives, 2020 – the section on digital resources, pages 34

presentation of the learning content, with no reference to using these available digital resources. An exception to this is found in a few of the teacher guides that have been recently revised in line with the new Educational Directives 2020. For example, the sixth-grade math teacher guide *Al Jayyed Fi Al Riyadiyyat*, pages 399- 406, includes some digital applications (i.e., EXEL, GEOGEBRA) to support the presentation of the learning content.

As for the pedagogical approaches, findings show that the Educational Directives 2020 and the theoretical part [142] (part 1) in the teacher guides offer diverse and effective learning approaches (i.e., enquiry-based, playing, problem solving, syllabic approach in reading subjects, research-based, group-based, early grade learning principles). Nonetheless, such approaches are not being used in the applied part of the teaching guides, which provides the direct teaching instructions and lesson plan cards that teachers naturally refer to in preparing and teaching subject lessons. For example, the Educational Directives 2020 and the theoretical part in the teacher guide for the sixth-grade French language textbook *mes apprentissages*, cite different pedagogical strategies such as research-based approach (pages 51-52 in the teacher guide), differentiated learning approach (page 8 in the teacher guide), and use of the dictionary and reading games (page 135), however, the lesson plan cards - in the practical guide (part 2), lacks such variety in learning strategies. In the practical guide, strategies appear to rely on the use of auditory and visual (pictures) modes of presentation and individual activities. There is also an absence of strategies that provide hands-on activities and real-life experience.

Q1 b. How do the TLMs align with UDL principle: <u>Multiple modes of expression?</u>

Findings to answer this sub-question were based on the data collected using the section on "Multiple Modes of Expression" in the UDLAC rubric – which comprised five statements assessing the alignment of the curriculum with this UDL principle. This second sub-question examines the extent to which the curriculum's design, pedagogical approaches, and learning and assessment activities allow students to express learning in different modes such as; visual (i.e., written texts, drawings, visual mapping, presenting, etc.), auditory (i.e., discussions, reading, music, signing, reciting, etc.), kinesthetics (i.e., drama, physical activities, building and designing objects, experiments, projects, etc.).

Findings based on the review of curricular materials showed that the Educational Directives 2020 and the theoretical part in teacher guides promote flexibility in how students respond to the different learning activities and how students express learning. Nonetheless, in the student textbooks and the practical part in teacher guides, these activities focus to great extent on visual and auditory modes of expression. Kinesthetic activities, on the other hand, are scant and modestly appear in some verbal expression activities, experiments in some physics topics, end-of-unit projects, and the technology projects. Examples can be seen in the third and sixth grades student textbook *mes apprentissages*, second grade math textbook *Al Marji'a fi Al Riyyadiat*, first grade student textbook and teacher guide *Al Moufeed Fi Al louggah Al Arabiya*. Findings also showed that learning and assessment activities are mainly individual with little focus on group or collaborative learning. Group and collaborative activities were found to be exclusive to activities that are involved in preparation sessions, group-assessment sessions, and unit projects. This obviously indicates that students are given few opportunities to work collaboratively as such activities are infrequent in the curriculum and account for a small percentage of its activities, as can be seen, for example, in the second unit in the science teacher guide and student textbook *Fadaa' Annashat Al ilmi*, and in unit five in the third grade Arabic language student textbook *Mourshidi Fi Al louggah Al Arabiya*.

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[142] The teacher guide across the different subjects and grade level includes two parts: part discusses theoretically the different pedagogical approaches that could be implemented in the curriculum. The second part contains the teaching instructions, detailed lesson plans for each lesson/unit in the curriculum – which teachers usually refer to in preparation for their classes.

Despite the Educational Directives 2020 calling for the importance of diversifying the assessment activities, the formative and summative assessment activities adopted in the assessment lessons in teacher guides rely largely on visual and auditory modes of expression at the expense of kinesthetic and collaborative modes. Unit two, for example, in the third-grade math teacher guide and student textbook *Fadaa' Al Riyyadiyat* assess students' learning mainly through written activities that appear in forms of exercises that students work on in their textbooks. Similarly, students learning in unit five in the sixth-grade science textbook *Fadaa' Annashat Al Ilmi* are assessed by asking students at the end of the session to answer a set of questions by writing the answers on their notebooks. Obviously in those two examples, collaborative and kinesthetic –based assessments (experiments, hands-on assessment activities) appear to be absent, as assessment here is focused on written assessments that require students to work individually.

Findings also showed a lack of activities or guidelines in the teacher guides that demonstrate to teachers how to diversify and differentiate the learning and assessment activities that will enable teachers to correspond to the learners' diverse needs and cultural and linguistic backgrounds. This finding is evident, for example, in unit two and five in the: second and sixth grades teacher guides *Mes apprentissages en français*, third-grade student textbook *Al Wadih Fi Annahshat Al ilmi*, second-grade student textbook *Fi Rihab Al lougghah Al Arabiya.*

Q1 c. How do the TLMs align with UDL principle: <u>Multiple methods of engagement?</u>
This sub-question is answered based on the data collected using the section on "Multiple Modes of Engagement" in the UDLAC rubric - which comprised eight statements assessing the alignment of the curriculum with this UDL principle. This sub-question examines the extent to which the curriculum's design, pedagogical approaches, and learning and assessment activities allow students to engage with learning in different ways and forms such as: individual and collaborative, peer learning, games, hands-on activities, real-life experiences, self-assessment activities, that will allow students to choose their preferred activities which would encourage the engagement of all learners – especially those with learning difficulties.

Findings in relation to this question showed that despite the emphasis on real-life experiences and practical activities in both enriching and facilitating learning in the Educational Directives 2020 [143] and the theoretical part in the teacher guides, the utilization of such activities and experiences in the TLMs is limited. This finding is evident, for example, in units two and five in the fifth-grade student textbook and teacher guide *Al moufeed Fi Al louggah Al Arabiya*, the unit five in the third-grade student science textbook and teacher guide *Al Wahdih Fi Annashat Al ilmi.*

The TLMs also, as revealed by this curriculum review, do not provide students with the opportunities to choose, plan and design the learning activities according to their preferences and interests. Such activities are all already dictated in the lesson plan. Moreover, opportunities for peer learning, collaborative work, learning through play, self-learning and self-assessments were also found to be scant across the curriculum materials. For example, units two and five in the third-grade French student textbook *Mes apprentissages en français*, and units two and five in the fifth-grade science teacher guide and student textbook *Manhal Annashat Al ilmi* are already planned and designed, leaving students with little opportunity to choose or contribute to the design of those activities.

Findings also showed that the theoretical part in of some teacher guides provide guidelines and directions on how to differentiate and adapt the different learning contents and activities, which would

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[143] See for example the Educational Directives 2020 for sixth-grade, pages: 192 and 201 -202.

enable the engagement of students who have learning difficulties. However, the implementation of those directions is absent in the lesson plans in the teacher guides. These directions are also not followed in the design of the activities provided in the student textbooks. Examples to support this finding can be seen in units two and five in the third-grade science teacher guide and student textbook *Al Wadah Fi Annashat Al ilmi*, and unit two - page 175, in the fourth-grade math teacher guide *Al Jayyed Fi Al Riyadiyyat*.

CONCLUSIONS

Question 1a

The teaching and learning materials (student textbooks and teacher guides), do not align to a great extent with the UDL principle of multi modes of presentation. This in large is due to the misalignment between the Educational Directives 2020, which emphasizes the use of multi modes of presentations, and the learning content that is presented in both the teacher guide and student textbooks. While the theoretical part of the teacher guides does introduce diverse and effective learning approaches, these are not modeled in the lessons and learning content from which teachers develop and implement lesson plans. Currently, the modes of presentations used in the curriculum focus largely on the visual presentations (mainly pictures in student textbook), and much less on other modes such as auditory and hands-on activities and real-life.

Moreover, the comprehensive vision that the written curriculum (i.e., The Educational Directives 2020) would incorporate the available digital resources in order to enrich the different modes of presentation, has not been effectively implemented in the teacher guide or student textbook. Finally, the use of the diverse pedagogical approaches suggested by the Educational Directives 2020 and the theoretical part of the teacher guides remains limited.

Question 1b

Teaching and learning materials moderately align with the UDL principle "multiple modes of expression," as they rely largely on visual and auditory expressions with limited adaptation of learning and assessment activities that require kinesthetics expressions. The learning and assessment activities are also characterized by independent learning with limited opportunities for group or collaborative work. Finally, the learning and assessment activities do not take into consideration the diverse characteristics and needs of the learners (i.e., those who have disability or come from diverse cultural background), and the teacher guides provide little guidance to support teachers catering for the diverse needs of the different learners.

Question 1c

The learning and teaching materials do not provide students with opportunities to engage with learning in different modes. Activities that include collaborative learning, learning through play, practical and real-life experiences, peer learning, self-assessment are limited in the curriculum. Also, limited attention is given to differentiated learning and individual differences in the teacher guides and student textbooks. These findings reflect a gap between the Educational Directives 2020 and the theoretical part in teacher guides - which emphasize the importance of utilizing different modes of engagement - and the teacher guides and student textbooks.

QUESTION 2

In the curriculum for primary grades (1-6), how do the TLMs promote equity and inclusion for all students considering the diversity of the Moroccan population (i.e., students with disabilities, female students, ethnic and cultural minorities, second language learners)?
The following three sections detail the findings for each of the focus areas, which are addressed as three sub-questions on: multicultural education, gender, and students with disabilities.

FINDINGS

Q2a. How do the TLMs align with the principles and practices of multicultural education?
This sub-question is answered based on the data collected using the section on "Aligning with principles of multicultural education" in the EDR rubric - which comprised five statements assessing the alignment of the curriculum with principles of multicultural education. This sub-question examines the extent to which the curriculum in its design, content, pedagogical approaches, and learning and assessment activities recognize and take into consideration the diversity of the student population in terms of their culture, social, demographic and language backgrounds. Issues, for example, around whether the curriculum characters and contents are reflective of the diverse population of the Moroccan society, if and how the curriculum provides support to second language learners, and whether the curriculum promotes multicultural values among students, were assessed in this review.

Findings showed that the characters presented in the curriculum, whether those characters appear in the lessons' contents or pictures, rarely reflect the cultural, social, demographic and language diversity of the Moroccan society. Contents of some language and science materials refer, in few instances, to names of characters and cities that are believed to reflect different Moroccan demographic areas (suburbs and rural) and different social groups. For example, unit two in the fourth-grade Arabic language student textbook *Al Moufeed Fi Al louggah Al Arabia* features a character with an Amazighian name (pages 76). Unit two in the fourth-grade math student textbook *Fadaa' Al Riyyadiate* refers to different names that are popular in the Moroccan society, one of them appears to be an Amazigh name. However, curriculum content, apart from these few exceptions, does not directly engage or make explicit reference to the different social, cultural or language groups within the society.

The curriculum content also does not present the historical and cultural events that enable learners to understand the characteristics and experiences of the different cultural, social and language groups, and learn about their contributions to the society. This was evident, for example, in units two and five in the second-grade Arabic language student textbook *Fi Rihaab Al Louggah* Al Arabiya, units two and five in the science textbook *Manhal Annashat Al ilmi*, units two and five in the third-grade French language textbook *Mes apprentissages en français*.

Findings also showed an absence of guidance and instruction provided in the curriculum to guide teachers in how to support second language learners (i.e., providing extra time, vocabulary maps, support during class and exams, etc.) in the different learning and assessment activities. With that said, it is worth mentioning that a language alternation approach, where, for example, science terms appear in French beside the Arabic, is sporadically applied in student textbooks. Research shows that this approach allows students to use another language in order to facilitate their understanding of the concepts. [144] Amazigh language is also taught as a school subject beside Arabic, which could be as seen as an acknowledgement of the language diversity in Morocco.

The curriculum provides limited opportunities that teach students to appreciate different ideas and respect the views of others. These opportunities, when offered, are exclusive to the discussion sessions such as those in the fourth-grade French textbook *Mes apprentissages en français*, unit five – page 161, and sixth-grade Arabic language textbook *Al Moufeed Fi Al louggah Al Arabia,* units two and five. These discussion sessions, nonetheless, are directed by teachers and do not encourage critical thinking and constructive discussions among students.

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Q2b. How do the TLMs align with equality principles for gender education?
The review data collected to answer this sub-question was based on the use of the second section of the EDR rubric "aligning with principles for gender education." This section comprised five statements (indicators) which assessed the alignment of the curriculum TLMs with principles of gender education, with focus on gender equality in terms of characters and gender roles presented in the TLMs, the language used, and appropriateness of learning activities for both genders.

The reviewed data showed that the language used in the curriculum explicitly addresses and acknowledges both genders. This is evident through the use of both feminine and masculine pronouns when addressing students or teachers in the teacher guides - speaker pronouns are used in the student textbooks (i.e., I and we). This equal use of gender pronouns can be seen across all teacher guides and student textbooks such as: units two and five in the first-grade Arabic student textbook and teacher guide *Al Moufeed Fi Allouggah Al Arabia*, and the units two and five in the sixth-grade science textbook and teacher guide *Fadaa' Annashat Al ilmi.*

Findings however, also revealed disproportionate presentation of male versus female characters, where male characters appear more frequently comparing to female characters in reading passages, and lesson exercises and examples. For example, the review team found that in the fourth-grade math student textbooks *Al Jayyad Fi Al Riyyadiat*, unit two depicts 16 pictures of male characters versus only 10 of females, and units five shows 11 male characters versus five females. Similarly, in unit five in the fifth-grade science textbook *Mannhal Annashat Al ilmi*, 71% of the names and characters that appear in the learning activities and exercises are for males versus 29% for females.

Moreover, findings showed that the curriculum, despite some modest attempts, adopts a stereotypical approach in portraying women and their roles and contribution to society. For example, leadership roles, high management positions, high profile achievements, and STEM jobs were attributed to men far more frequently than those attributed to women. Women appear more in stereotypical roles such as teachers, nurses, mothers, versus men appearing as leaders, doctors, judges, engineers, scientist, etc. Different examples can be cited from students' textbooks to demonstrate this inequality. For example, in unit two in the third-grade Arabic student textbook *Murshidi Fi Allouggah Al Arabia* on pages 43, the man characters appear as a camp leader, while on page 45, the woman character appears as a teacher. In the same textbook, the person who is able to solve problems and has insightful solutions is a man. Even when the curriculum attempts to present both genders in the same roles, the male figure tends to be cited before the female figure (i.e., men and women engineers, men and women doctors, men and women specialists) - *Murshidi Fi Allouggah Al Arabia,* page 54.

Gender inequality is also seen in the curriculum, which fails to equally captures the role and contribution of both women and men to society and in the different fields of science. For example, unit two (page 30) in the fifth-grade science textbook *Mannhal Annashat Al ilmi* presents a male scientist and a discussion about his achievements to the field of science. A similar example from the same textbook, in unit five, is given about a male inventor with discussion of the contributions he made to his field (page 64). Female scientists, inventors, writers or historical figures, on the other hand, did not receive the same acknowledgement and their contributions to the different scientific fields and society were not equally recognized.

Q2c. How do the TLMs align with equity and equality principles for disability?
Findings to answer this sub-question were based on the data collected using the section on "Aligning with Principles for Children with Disabilities" in the EDR rubric. This rubric section consisted of six statements that examine the extent to which the curriculum design, content, resources, and pedagogical approaches are accessible and inclusive of the students with disabilities.

The curriculum review shows that the *Frame of Reference for Inclusive Education* 2019 (FRIE) document seems to provide a clear framework for the educational measures and procedures that need to be in place in order to facilitate the inclusion of students with disabilities. This framework, however, is developed as an independent document and separate from both the curriculum document and the TLMs. **This separation has resulted in full absence of all educational measures and instructions related to the inclusion of the students with disabilities from the TLMs materials.** For example, teacher guides do not provide instructions on how adapt and differentiate the learning content, activities and assessment for those students. Teachers, consequently, would have to refer to the FRIE document in order to learn how to design and deliver the curriculum in a way that is accessible to those students.

This separation adds another step to the lesson planning since the current lesson plans, provided in the teacher guides, do not include these accommodations. Additionally, decisions on how to include them in lessons is left to the teachers to figure out. The extent to which teachers consult with FRIE in order to make the necessary changes to the existing learning outcomes, pedagogies, activities, and assessment (which are explained in the lesson plans in the teacher guides), or whether they are equipped with the knowledge and skills to apply those adaptations, is beyond the scope of this review. The review of curriculum content has shown that the TLMs do not, in their present design and content, account for the needs and characteristics of students with disabilities.

Furthermore, and linked to the previous finding, it was found that adapted learning materials and tools (i.e., Braille printed material, audiotapes, models, tactile objects, etc.) are available through some international organisations that have taken the responsibility of providing modified learning materials to students with different types of disabilities. For example, the Alaouite organisation for the welfare of people with visual impairment *Al Mounthamah Al laoyiah lereia'yet Al makfoufeen* prints student textbooks in Braille language. Nonetheless, the current curriculum makes no reference to these tools and how teachers can utilize them to support students with disabilities in the classroom. This finding indicates that the educational services available to students with disabilities are offered separate from the mainstream curriculum, which could mean that these students are still segregated with limited access to mainstream educational services – which, in essence, contradicts the fundamental concept and practices of inclusive education.

As for the extent to which the TLMs encourage the development of positive attitudes towards disability, and whether they promote positive image of the people with disabilities, findings showed that few references are made to people with disabilities in the curriculum materials, with only few instances where the curriculum discusses their role and contribution to the society and present prominent figures who, despite their disability, became scientists, athletes, writers, musicians, artists and leaders. The limited references to disability appear in the curriculum through pictures and characters of people with disabilities, as seen in unit two in the third-grade Arabic student textbook *Murshidi Fi Allouggah Al Arabia – page 61*. The curriculum also gives little attention to discussing the different challenges people of disabilities face and their roles and contributions to society. For example, the Arabic student textbooks across the grades 1-6, show people with disabilities appearing in lesson pictures or reading texts only: grade- two shows pictures of children with physical disability, *Fi Rihaab Al louggah Al Arabia* - pages 35 & 36, grade-five student textbook *Murshidi Fi Al louggah Al Arabia,* page 47 – a story about a girl with physical disability, and grade six student textbook *Kitabi Fi Al Louggah Al Arabia*, - a reading text on the right of the children with disabilities (unit 2, page 43), and a reading text on Taha Hussain – a famous Egyptian scholar with visual impairment (unit 5, page 193).

CONCLUSIONS

Question 2a

The alignment between the curriculum TLMs and the different practices of multicultural education is, to a great extent, limited. The curriculum characters, in both learning content – especially pictures within lessons - do not reflect the cultural, social and language diversity of the Moroccan society. Also, the learning content provides learners with limited opportunities to learn about the historical events and the cultural characteristics and achievements of the different social, cultural groups in the society. Moreover, and despite acknowledging the language diversity in the Moroccan society, the teacher guides do not provide teachers with guidance on how to support second language students and ensure they are provided with equity learning opportunities. Finally, the curriculum content and pedagogical approaches provide limited opportunities that would teach students how to respect ideas that are different to theirs and respect others' points of view.

Question 2b

Gender equality appears in the TLMs, to great extent, in the equal use of both feminine and masculine pronouns but appears to a lesser extent in the number of female and male characters depicted in the curriculum. The stereotypical image of women – one that depicts their limited abilities and capacities to participate and contribute to the different social and scientific fields and carry on leadership and decision-making roles - persists across the curriculum materials.

Question 2c

The framework and guide on inclusive practices and their implementations are available to schools and teachers in Morocco, but provided separate from the mainstream curriculum TLMs, an issue that is seen as an obstacle toward achieving a full and effective inclusion of students with disabilities. The TLMs occasionally make, in few instances, references to people with disabilities through some pictures or reading texts, but with few discussions of the roles and contributions of people with disabilities to society, which would help students to develop positive attitudes toward people with disabilities.

RECOMMENDATIONS

In light of the Ministry of Education's vision, the review team recommends that the Ministry of Education **appoints an Inclusive Curriculum and Instruction Committee that guides the revision and implementation of an inclusive curriculum across all school stages and grades.** The committee members should include the different stakeholders involved in the educational process. This could include, but not be limited to school leaders, teachers, curriculum experts, educational researchers, parents and civil society organizations that are involved in supporting the education of children with special learning needs and multicultural and gender education. It is also recommended that the appointees of this committee are diverse in terms of their gender, and social and cultural background, and include people with disabilities.
Top priorities for the Inclusive Curriculum and Instruction Committee:

1. Ensure a **comprehensive and appropriate alignment** between the *Educational Directives* 2020, and the implementation of UDL's three principles: diverse modes of presentation, expression, and engagement presented across the curriculum (in both textbooks and teacher guides). Specifically, principles must be incorporated in lesson planning sections of teacher guides, not limited to theoretical (part I).

    a. **Modes of Presentations**: Include a variety of visual, auditory, and hands-on, and real-life presentations and reduce reliance on the student textbook as a main medium to present the learning content.

b. **Modes of Expressions**: Include guidelines in teacher guides on how to expand beyond individual visual and auditory learning and assessment activities to incorporate kinesthetic and collaborative expressions of learning that meet and accommodate students' diverse needs and characteristics.
c. **Modes of Engagement**: Enrich the learning activities and pedagogical approaches in the teacher guides and student textbooks to provide more opportunities to learn through collaborative, real-life, practical games, and self-learning/assessing activities, and ensure that learners are given opportunities to choose and plan their learning activities according to their preferences and needs.

2. **Develop a framework that ensures curriculum alignment and implementation of practices and principles of multicultural, gender, and disability education:**
   a. Ensure that the curriculum explicitly and frequently portray and discuss the cultural, social, demographical and language diversity within the Moroccan society, and that it provides students with activities that encourage them to appreciate and respect others' views and differences.
   b. Ensure that the curriculum resources (i.e., teacher guides) offer guidance and alternative approaches to support second language learners, and students who come from bilingual backgrounds.
   c. Ensure equal presentation of both genders in the curriculum by avoiding a stereotypical presentation of women/girls in the curriculum content and equally presenting their roles and contributions to society.
   d. Incorporate the *Frame of Reference for Inclusive Education* 2019, which provides detailed guidance for teaching learners with disabilities, into the curriculum's different teaching and learning materials. This document is presently isolated, and consequently inclusive practices and directives operate apart from teacher guides and textbooks, and TLMs. As a result, inclusion is dependent on teachers' training and individual initiatives, providing an uneven learning environment for all students.
   e. Ensure that he TLMs go further to encourage the development of positive attitudes toward people with disabilities through including their success stories and different contributions to society in the curriculum lessons.

While curriculum change is necessary to ensure that all learners are provided with an equal opportunity to learn, the curriculum revisions will not alone ensure an adequate and appropriate implementation of the different inclusive practices in the classroom. Developing an inclusive system and culture is multifaceted, and therefore, the Inclusive Curriculum and Instruction Committee would be encouraged to put in place a comprehensive plan for the implementation of an inclusive system. This plan would include providing teachers with training that equips them with knowledge and skills necessary for working in inclusive classrooms. For example, teachers need to: understand the needs of different learners, how to design and implement inclusive instructions and assessments, how to support students who require extra help, how to use information and communications technology (ICT) to facilitate learning, and how to work collaboratively with other stakeholders to implement inclusive practices. The plan should also include revision of educational polices to ensure their support of inclusion of all learners.

The committee, furthermore, would ideally be encouraged to continuously examine the different challenges and barriers to inclusive education and work on tackling them as they arise. These barriers could be related to society's attitudes (that of: schools, teachers, parents and students) toward students with certain characteristics and who might appear different to the others (i.e., students coming from a different language or ethnicity group, or who have disability). Designing plans to support the development of positive attitudes towards those groups of students is key for the successful implementation of an inclusive curriculum. Other barriers to inclusion could be environment-based, such as lack of resources, as well as school and classroom structure (e.g., large classrooms, large teaching loads, etc.). These issues might undermine the implementation of an inclusive curriculum and the Inclusive Curriculum and Instruction committee could be encouraged to identify issues as they occur and propose and implement practical steps to offset their adverse impact on the successful implementation of the inclusive curriculum.

Areas for Further Investigation

During the participatory workshops and curriculum review, the team at times discussed challenges and opportunities outside the scope of the CCA activity, but have merit for further investigation. These areas include:

Potential Challenge	Potential Opportunity
Many Publishers in different regions of the country use different textbooks.	Work with publishers to understand the benefits and challenges raised by using multiple textbooks.
Not all schools are equally equipped with technology. And teachers might not be equally equipped with ICT skills needed to effectively use technology to support all students.	Assess the status technology equipment (and ability to use equipment) in rural and urban schools. This may uncover resources, equipment, capacities, and attitudes towards ICT that would need to be addressed jointly.
Online learning is assumed to affect children differently. But more information is needed about how online learning affect children with disabilities, children in lower economic conditions, and children with linguistic challenges.	Survey teachers and students to determine if and how online learning has affected at-risk students- those with disabilities, in lower economic conditions, with linguistic challenges.
Teachers need continuous training on curriculum and learning design for inclusive education and how work in inclusive settings that support all learners.	Pre and in-service-teacher preparation programs should provide teachers with training on how to design learning and assessment for all learners, how to manage inclusive classrooms, adopt inclusive practices and collaborate with all stakeholders to support the inclusion of all children.
Teachers need support to modify and adapt the curriculum and learning materials.	Recommended curricular changes are more likely to be implemented as intended if teachers are provided additional training, as well as provided time and compensation to modify the curriculum and learning materials to meet the needs of all learners.
Collaboration between schools and parents of children with disability might be limited and might not involve including parents in making decisions related to their children (I.e. how they learn and should be assessed, curriculum accommodations, etc.).	Parents committees/boards could be established to encourage continuous communication and collaboration between parents and schools.
Parents may be hesitant to inform schools about children's learning needs due to concerns over stigma or isolation.	Parent education about inclusive classrooms and available accommodations may make parents more

	willing to candidly discuss when their children are struggling to learn.

ANNEX 1: FINAL RUBRICS USED IN REVIEW

TASK 1A – ARABIC LITERACY ALIGNMENT RUBRICS

Arabic Language Curriculum Rubric

Standards	#	Attainment Indicators	Attainment Rate	Remarks and Evidence

Attainment Scale: 1=Unmet 2= Relatively met- 3= Met 99=N/A
Reviewed Documents: D: Directives ; TG : Teacher guide; ST: student textbook

			D	TG	ST	
I- Focus on universal values and contemporary issues.	1	Use of universal values as an entry point that informs educational contents, strategies, and practices.				
	2	Extensive tackling of the fundamental universal concepts, big questions, and common human values in a fashion that is made developmentally appropriate to each grade level.				
	3	Prepares learners to be responsible citizens towards their homeland and the humanity.				
	4	Provides learners with the opportunity to become aware of the concepts of human values, human rights, equal opportunities, and translate them into practices and attitudes consistent with the peculiarities of society.				
		Attainment rates as per reviewed documents				General rate of standard attainment
Comments: Conclusions						
II. Durable, consistent, and harmonious curriculum foundations	5	The curriculum relies on non-changeable teaching philosophy and pedagogical				

	6	Contents should align with the foundations, the philosophy of education and the methods of evaluation.				
	7	Provide an overview of the scientific evidence that informed materials development				
	8	Contents should be linked to meeting standards and developing competencies.				
Comments: Conclusions						
III .Student-centered	9	Consider peculiarities of learners needs and building upon their experiences and interests.				
	10	Clearly define characteristics of the target learners' category.				
	11	Include clear directives to be invested and used in self-learning.				
	12	Provide suitable and sufficient learning opportunities to enable all learners to practice each standard/competency and master it.				
		Attainment rates as per reviewed documents				General rate
Comments: Conclusions						
IV . Clear and flexible instructional design	13	Provide clear, graded, growing, and interconnected learning pathways				
	14	Allow for dropping some of the horizontal content to the goal of deepening the vertical content				
	15	Differentiate instruction to support underperforming students and to give smart ones the opportunity to enrich their learning.				
	16	Catering for the diverse needs, renewed interests, and present contexts.				
	17	Invest diverse methods and efficacious strategies while defining their domain of use, to serve the objectives set out for all the teaching and learning processes.				

	18	Progressive organization of the curricula in a way that reflects standard domain units, and allows for monitoring the competency's spiral development through defining the sequence of skills' development and logical concepts progression in alignment and consistency with the hierarchical nature of skills / concepts.				
	19	Coordinate programs in a way that is easy, practical, and suitable for teachers' different backgrounds, knowledge, and skills				
	20	Clear linkages between the different components and approaches, and the provision of areas for their investment and their synthesis through meaningful projects.				
		Attainment rates as per reviewed documents				General rate
Comments: Conclusions						
V. Comprehensive and balanced Instructional Design	21	Focus on developing lifelong learning competency through a systematic build up of the skills in a way that engages learners, sparks their imagination, and motivate them to self-learning and continue learning.				
	22	Contents should cover all national standards/competencies according to the appropriate level for each grade.				
	23	Promote independence and critical sense.				
	24	Consolidate and support the new learning outcomes in a way that would help all learners to progress, at their own pace, towards the final competencies.				
	25	Provide learners with the time and opportunity to read and work independently to invest their learning in various activities.				
	26	Give importance and room to developing higher- order thinking skills and the 16 habits of mind among learners, considering the gradual development of competencies.				

	27	Provide sufficient opportunities for an early intervention and support for underperforming learners.				
	28	Use of differentiated instruction designed to meet the reading, linguistic and writing needs of learners, these needs are defined based on examinations and monitoring of the progress.				
	29	Organize contents and activities according to the domains laid in the curriculum in a way that reflects the development of mastery levels of strategies.				
	30	Use of active interactive learning to develop learners' thinking and language.				
	31	Aligning curriculum's outcomes with the six levels of Bloom's Taxonomy while focusing on building up conceptual knowledge.				
		Attainment rates as per reviewed documents				General rate
Comments: Conclusions						
VI-Openness to other subjects and life	32	Allowing for integrating other subjects' skills and contents (inter-subjects thinking).				
	33	Interdependent learning in various disciplines and its relevance to life, global issues and to past, present, and future events.				
	34	Providing significant and motivating opportunities for learners' intellectual, physical, emotional, social, scientific, aesthetic, and creative development.				
	35	Building bridges between the various subjects to help learners build a cross-sectional background knowledge.				
	36	Leverage digital interactive educational resources to support cooperation between school and the family.				
Comments: Conclusions						

VII. Providing all pedagogical, didactic materials, and scaffolding to facilitate teaching and learning processes.	37	Provide models for various planning, evaluation, and performance level monitoring tools.				
	38	Provide clear instructions and directions on the key content and how to organize and generate knowledge in the basic components of language learning.				
	39	Provide rubrics that clearly demonstrate a coherent and methodological progress in developing each component of Arabic language teaching.				
	40	Allow for freedom of creation and diversified teaching methods and strategies.				
	41	Use of research-based alternative strategies.				
	42	Provide guidance to teachers on how to identify and anticipate challenges inherent in the lesson, and suggestions to provide additional support for learners who may need it.				
	43	Provide teaching Plans (samples of lesson plans) that are user-friendly / cohesive, with a logical sequence within the lessons.				
	44	Use of various instructional strategies to enhance learners' engagement and self-involvement in building their learning.				
	45	Accompany materials by clear explanations, and examples that are appropriate to the grade level				
	46	Include practical rubrics for teacher's self-verification of the degree to which performance is aligned with the levels of expectations for the desired objectives.				
	47	Provide tools to help build and sharpen teachers' skills.				

	48	Devise and design contents in line with learners' peculiarities and skill needs.				
	49	Explicitly lay out the instructional goals and learning tasks for learners.				
		Attainment rates as per reviewed documents				General rate
Comments: Conclusions						
VIII. Alignment with international best practices in teaching and learning language arts	50	Align national standards /competencies with all standards of language arts (including foundational skills: listening, speaking, reading, writing and language)				
	51	The materials and content provided align with the principles of UDL, meet the diverse needs of learners, and are easily accessible for all learners.				
	52	Provide high quality and depth graded content in a uniform manner across all learners' groups				
	53	Use of appropriate levels of early intervention consistent with response models.				
	54	Coherence and complementarity of the various language arts components for building the linguistic competency.				
	55	Use and encourage the use of a harmonious language in terms of standards across contents and grades.				
	56	Utilize literature and the four types of reading. in addition to using a variety of resources, including books, magazines articles, electronic journals and websites, movies, radio, and social media channels				
	57	Align performance standards informing the curriculum with the global curriculum in the field of languages.				
		Attainment rates as per reviewed documents				General rate
Comments: Conclusions						

IX. providing an integrated assessment system	58	Clearly align all assessments with the national standards /competencies.				
	59	clearly define standards / competencies and evidence of their mastery levels, and performance indicators specific to each level.				
	60	Use of various assessment tools relevant to subject specificity and assessment type: continuous formative, diagnostic, summative, learning file, reflective evaluations, and projects.				
	61	Formative and diagnostic assessment generate data to inform intervention and devise appropriate plans for support, remediation, and enrichment.				
	62	Provide an opportunity for immediate feedback that would help learners enhance their learning.				
	63	Diagnostic and formative assessments should be able to measure learners' progress towards meeting standards.				
	64	Harmony and consistency of diagnostic and formative assessments with the expectations and methods of summative assessment.				
	65	The use of assessment rules that specify performance features of learners who have met, exceeded, or did not meet standards, along with specifying the instructional procedures relevant to each case.				
	66	The presence of self-evaluation and reflection				
		Attainment rates as per reviewed documents				General rate
Comments: Conclusions						

TASK 1A – STEM ALIGNMENT RUBRICS

SCIENCE AND TECHNOLOGY

Rubric for Evaluating Science & Technology Curricula & its Teaching

CG= Curriculum Guide TG= Teachers Guide ST= Student Textbook

3: High 2: Medium 1: Low

Domain 1 Science as Inquiry

A. Opportunities for developing abilities necessary to do scientific inquiry.	CG	TG	ST	Evidence
	3>2>1			
1. Students are requested to identify questions that can be answered through scientific investigations.				
2. Students are requested to design and conduct a scientific investigation.				
3. Students are requested to use appropriate tools and techniques to gather, analyze, and interpret.				
4. Students are requested to develop descriptions, explanations, and models using evidence.				
5. Students are requested to think critically and logically to make the relationships between evidence and explanations.				
6. Students are requested to recognize and analyze alternative explanations and predictions.				
7. Students are requested to communicate scientific procedures and explanations.				
8. Students are requested to use mathematics in all aspects of scientific inquiry.				
Comments:				
Degree of Compliance:				

B. Opportunities for students to develop understandings about scientific inquiry.	**CG**	**TG**	**ST**	**Evidence**
	3>2>1			
1. Students are guided to understand different kinds of questions suggest different kinds of scientific investigations.				
2. Students are guided to understand current scientific knowledge and understanding guide scientific investigations.				
3. Students are guided to understand mathematics is important in all aspects of scientific inquiry.				
4. Students are guided to understand technology used to gather data enhances accuracy and allows scientists to analyze and quantify results of investigations.				
5. Scientific explanations emphasize evidence, have logically consistent arguments, and use scientific principles, models, and theories.				
6. Students are guided to understand that science advances through legitimate skepticism. Asking questions and querying other scientists' explanations is part of scientific inquiry.				
7. Students are guided to understand that scientific investigations sometimes result in new ideas and phenomena for study, generate new ideas and phenomena for study, generate new methods or procedures for an investigation, or develop new technologies to improve the collection of data.				
Comments:				
Degree of Compliance:				

Domain 2 — Science & Technology

A. Students develop abilities of technological design.	**CG**	**TG**	**ST**	**Evidence**
	3>2>1			
1. Students have opportunities to identify appropriate problems for technological design.				
2. Students have opportunities to design a solution or product.				
3. Students have opportunities to implement a proposed design.				
4. Students have opportunities to evaluate completed technological designs or products.				

5. Students are requested to communicate the process of technological design.				
Comments:				
Degree of Compliance:				
B. Students develop understandings about science and technology	**CG**	**TG**	**ST**	**Evidence**
	3>2>1			
1. Students are guided to understand that scientific inquiry and technological design have similarities and differences: Scientists propose explanations for questions about the natural world, and engineers propose solutions relating to human problems, needs, and aspirations. Technological solutions are temporary; technologies exist within nature and so they cannot contravene physical or biological principles; technological solutions have side effects; and technologies cost, carry risks, and provide benefits.				
2. Students are guided to understand science and technology are reciprocal. Science helps drive technology, as it addresses questions that demand more sophisticated instruments and provides principles for better instrumentation and technique. Technology is essential to science, because it provides instruments and techniques that enable observations of objects and phenomena that are otherwise unobservable due to factors such as quantity, distance, location, size, and speed. Technology also provides tools for investigations, inquiry, and analysis.				
3. Students are guided to understand perfectly designed solutions do not exist. All technological solutions have trade-offs, such as safety, cost, efficiency, and appearance. Engineers often build in back-up systems to provide safety. Risk is part of living in a highly technological world. Reducing risk often results in new technology.				
4. Students are guided to understand technological designs have constraints. Some constraints are unavoidable, for example, properties of materials, or effects of weather and friction; other constraints limit choices in the design, for example, environmental protection, human safety, and aesthetics.				
5. Students are guided to understand technological solutions have intended benefits and unintended consequences. Some consequences can be predicted, others cannot.				
Comments:				
Degree of Compliance:				

Domain 3 — Science in Personal & Social Perspective

A. Students develop understanding of science and technology in society	CG	TG	ST	Evidence
	3>2>1			
1. Students are guided to understand that societal challenges often inspire questions for scientific research, and social priorities often influence research priorities through the availability of funding for research.				
2. Students are guided to understand that technology influences society through its products and processes. Technology influences the quality of life and the ways people act and interact. Technological changes are often accompanied by social, political, and economic changes that can be beneficial or detrimental to individuals and to society. Social needs, attitudes, and values influence the direction of technological development.				
3. Students are guided to understand that scientists and engineers work in many different settings, including colleges and universities, businesses and industries, specific research institutes, and government agencies.				
4. Students are guided to understand that science cannot answer all questions and technology cannot solve all human problems or meet all human needs. Students should understand the difference between scientific and other questions. They should appreciate what science and technology can reasonably contribute to society and what they cannot do. For example, new technologies often will decrease some risks and increase others.				
Comments:				
Degree of Compliance:				

Domain 4 — History & Nature of Science

A. Students develop understanding of science as a human endeavor.	CG	TG	ST	Evidence
	3>2>1			
1. Students are guided to understand that women and men of various social and ethnic backgrounds--and with diverse interests, talents, qualities, and motivations-				

-engage in the activities of science, engineering, and related fields such as the health professions.				
2. Students are guided to understand that science requires different abilities, depending on such factors as the field of study and type of inquiry. Science is very much a human endeavor, and the work of science relies on basic human qualities, such as reasoning, insight, energy, skill, and creativity--as well as on scientific habits of mind, such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas.				
Comments:				
Degree of Compliance:				
B. Students develop understanding of nature of science.	**CG**	**TG**	**ST**	**Evidence**
	3>2>1			
1. Students are guided to understand that scientists formulate and test their explanations of nature using observation, experiments, and theoretical and mathematical models. Although all scientific ideas are tentative and subject to change and improvement in principle, for most major ideas in science, there is much experimental and observational confirmation. Those ideas are not likely to change greatly in the future. Scientists do and have changed their ideas about nature when they encounter new experimental evidence that does not match their existing explanations.				
2. Students are guided to understand that in areas where active research is being pursued and in which there is not a great deal of experimental or observational evidence and understanding, it is normal for scientists to differ with one another about the interpretation of the evidence or theory being considered. Different scientists might publish conflicting experimental results or might draw different conclusions from the same data. Ideally, scientists acknowledge such conflict and work towards finding evidence that will resolve their disagreement.				
3. Students are guided to understand that it is part of scientific inquiry to evaluate the results of scientific investigations, experiments, observations, theoretical models, and the explanations proposed by other scientists. Evaluation includes reviewing the experimental procedures, examining the evidence, identifying faulty reasoning, pointing out statements that go beyond the evidence, and suggesting alternative explanations for the same observations. Although scientists may disagree about explanations of phenomena, about interpretations of data, or				

about the value of rival theories, they do agree that questioning, response to criticism, and open communication are integral to the process of science. As scientific knowledge evolves, major disagreements are eventually resolved through such interactions between scientists.				
Comments:				
Degree of Compliance:				

Domain 5 Student Assessment in Science

A. Students are offered high quality opportunities of assessment *of* learning in science	**CG**	**TG**	**ST**	**Evidence**
	3>2>1			
1. Students are assessed in terms of their declarative knowledge.				
2. Students are assessed in terms of their procedural knowledge.				
3. Students are assessed in terms of their attitudes and habits of the mind.				
4. Assessment offered to students is based on clearly stated criteria.				
Comments:				
Degree of Compliance:				
B. Students are offered high quality opportunities of assessment *for* learning in science	**CG**	**TG**	**ST**	**Evidence**
	3>2>1			
1. Students are offered assessment opportunities that are based on authentic tasks & meaningful science learning processes & contexts.				
2. Students are offered assessment opportunities that are multi-dimensional, and uses a wide range of tools and methods.				
3. Assessment offered to students is a collaborative process involving students.				
4. Assessment opportunities are ongoing and continuous.				
5. Assessment opportunities support differentiation of student learning.				
C. Students are offered high quality opportunities of assessment *as* learning in science	**CG**	**TG**	**ST**	**Evidence**

	3>2>1			
1. Students are offered the opportunities to reflect on their learning.				
2. Students are offered assessment opportunities that are based on criteria that they know and understand, & appealing to their strengths.				
Comments:				
Degree of Compliance:				

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Rubric for Evaluating Technology Curriculum & its Teaching

Standard 1 Aims *CG= Curriculum Guide - TG= Teachers Guide - ST= Student Textbook* *3: High - 2: Medium - 1: Low*	**CG**	**TG**	**ST**	**Evidence**
	3>2>1			
1. Students are provided with opportunities to understand that all design and technological activity takes place within contexts that influence the outcomes of design practice.				
2. Students are provided with opportunities to develop a broad knowledge of materials, components and technologies and practical skills to develop high quality, imaginative and functional prototypes.				
3. Students are provided with opportunities to explore and take design risks in order to stretch the development of design proposals.				
4. Students are provided with opportunities to consider the costs, commercial viability and marketing of products.				
5. Students are provided with opportunities to use key design and technology terminology including those related to: designing, innovation and communication;				

materials and technologies; making, manufacture and production; critiquing, values and ethics.				
Comments:				
Degree of Compliance:				
Standard 2 Technical Principles *CG= Curriculum Guide - TG= Teachers Guide - ST= Student Textbook* *3: High - 2: Medium - 1: Low*	**CG**	**TG**	**ST**	**Evidence**
	3>2>1			
1. Students are provided with opportunities to explore the impact of new and emerging technologies on industry, enterprise, sustainability, people, culture, society and the environment, production techniques and systems.				
2. Students are provided with opportunities to examine how the critical evaluation of new and emerging technologies informs design decisions; considering contemporary and potential future scenarios from different perspectives, such as ethics and the environment.				
3. Students are provided with opportunities to explore developments in modern, smart materials and composite materials				
4. Students are provided with opportunities to explore sources, origins, physical and working properties of the material categories or the components and systems, and their ecological and social footprints.				
5. Students are provided with opportunities to investigate the ways in which the selection of materials or components is influenced by a range of factors, such as functional, aesthetic, environmental, availability, cost, social, cultural and ethical.				
6. Students are provided with opportunities to explore stock forms, types and sizes in order to calculate and determine the quantity of materials or components required.				
7. Students are provided with opportunities to explore alternative processes that can be used to manufacture products to different scales of production.				
Comments:				
Degree of Compliance:				

Standard 3 Designing & Making Principles *CG= Curriculum Guide - TG= Teachers Guide - ST= Student Textbook* *3: High - 2: Medium - 1: Low*	**CG**	**TG**	**ST**	**Evidence**
		3>2>1		
1. Students are guided to understand that all design and technological practice takes place within contexts which inform outcomes.				
2. Students are provided with opportunities to develop, communicate, record and justify design ideas, applying suitable techniques, for example: formal and informal 2D and 3D drawing; system and schematic diagrams; annotated sketches; exploded diagrams; models; presentations; written notes; working drawings; schedules; audio and visual recordings; mathematical modelling; computer-based tools.				
3. Students are given chances to design and develop prototypes that responds to needs and/or wants and is fit for purpose, demonstrating functionality, aesthetics, marketability and consideration of innovation				
Comments:				
Degree of Compliance:				

Standard 4 Apply in-depth Knowledge *CG= Curriculum Guide - TG= Teachers Guide - ST= Student Textbook* *3: High - 2: Medium - 1: Low*	**CG**	**TG**	**ST**	**Evidence**
		3>2>1		
1. Students are provided with opportunities to investigate new and emerging technologies.				
2. Students are provided with opportunities to utilize specialist tools and equipment, appropriate to the materials or components used (including hand tools, machinery, digital design and manufacture), to create a specific outcome.				
Comments:				
Degree of Compliance:				

Standard 5 Links to Mathematics *CG= Curriculum Guide - TG= Teachers Guide - ST= Student Textbook* *3: High - 2: Medium - 1: Low*	**CG**	**TG**	**ST**	**Evidence**
		3>2>1		

1. Students are requested to carry out calculation of quantities of materials, costs and sizes.				
2. Students are requested to carry out scaling of drawings.				
3. Students are requested to carry out measurements and marking out, & creating tessellated patterns.				
Comments:				
Degree of Compliance:				
Standard 6 Links to Science *CG= Curriculum Guide - TG= Teachers Guide - ST= Student Textbook* *3: High - 2: Medium - 1: Low*	**CG**	**TG**	**ST**	**Evidence**
	3>2>1			
1. Students are guided to use appropriate scientific terms.				
2. Students are provided with instances where they carry out calculation of quantities, measurement of materials and selection of components.				
3. Students are provided with opportunities to carry out classification of the types and properties of a range of materials.				
4. Students are provided with opportunities to select materials and components based on ethical factors, taking into consideration the ecological and social footprints of materials.				
5. Students are guided to gain the knowledge of properties of materials to be applied when designing and making.				
Comments:				
Degree of Compliance:				

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MATH

MATH RUBRIC

0=Not Found (NF)	The curriculum and its materials do not support this element.
1= Low (L)	The curriculum and its materials contain limited support for this element, but the support is not embedded or consistently present within and across grades.
2= Medium (M)	The curriculum and its materials contain support for this element, but it is not always embedded or consistently present within and across grades.
3= High (H)	The curriculum and its materials contain embedded support for this element so that it is consistently present within and across grades.
T	Textbook
TG	Teacher Guide
CS	Curriculum Standards

Component 1: Content Coverage		**Recommended % of coverage**	**Descriptors/Indicators**	CS	T	TG
Mathematics Proficiency	Problem Solving	Varies	demonstrate understanding, ability to plan, do and check work during solution of a mathematical problem			
	Reasoning		recognize various problem elements associated with a task, recognize and use concepts and procedures to assist with solution attempts, justify approaches, concepts and procedures used			

	Communication		using appropriate mathematical vocabulary, connecting ideas to everyday life, interpreting mathematical statements			
Number Knowledge (50%)	Pre Number Ideas	20	Number Sense: counting concrete objects, number words, number games, rhymes			
			Operations with objects: grouping and taking away concrete objects from a collection of objects			
	Numbers and Number Systems: Whole Numbers		Demonstrate knowledge of place value (2-digit to 6-digit numbers); represent whole numbers with words, diagrams, number lines, or symbols; order numbers.			
			Add and subtract (up to 4-digit numbers), including computation in simple contextual problems.			
			Multiply (up to 3-digit by 1-digit and 2-digit by 2-digit numbers) and divide (up to 3-digit by 1-digit numbers), including computation in simple contextual problems.			
			Solve problems involving odd and even numbers, multiples and factors of numbers, rounding numbers (up to the nearest ten thousand), and making estimates.			
			Combine two or more properties of numbers or operations to solve problems in context.			
			Explore number systems other than base ten			
	Expressions, simple equations, and relationships	15	Find the missing number or operation in a number sentence			

			Identify or write expressions or number sentences to represent problem situations that may involve unknowns.			
			Identify and use relationships in a well-defined pattern (e.g., describe the relationship between adjacent terms and generate pairs of whole numbers given a rule).			
	Fractions and decimals	10	Recognize fractions as parts of wholes or collections; represent fractions using words, numbers, or models; compare and order simple fractions; add and subtract simple fractions, including those set in problem situations.			
			Demonstrate knowledge of decimal place value including representing decimals using words, numbers, or models; compare, order, and round decimals; add and subtract decimals, including those set in problem situations.			
Measurement & Geometry (30%)	Measurement: Nonstandard and Standard Units	15	Measure and estimate lengths (millimeters, centimeters, meters, kilometers); solve problems involving lengths.			

			Solve problems involving mass (gram and kilogram), volume (milliliter and liter), and time (minutes and hours); identify appropriate types and sizes of units and read scales.			
			Solve problems involving perimeters of polygons, areas of rectangles, areas of shapes covered with squares or partial squares, and volumes filled with cubes.			
	Geometry: Geometric Shapes and Objects; Position and Direction; Properties of Space	15	Identify and draw parallel and perpendicular lines; identify and draw right angles and angles smaller or larger than a right angle; compare angles by size.			
			Use elementary properties, including line and rotational symmetry, to describe, compare, and create common two-dimensional shapes (circles, triangles, quadrilaterals, and other polygons).			
			Use elementary properties to describe and compare three-dimensional shapes (cubes, rectangular solids, cones, cylinders, and spheres) and relate these with their two-dimensional representations.			
			translating, rotating, reflecting and dilating various geometric shapes and objects			
			locating geometric shapes and objects in the Cartesian plane			

Data (20%)	Reading, interpreting, and representing data	15	Read and interpret data from tables, pictographs, bar graphs, line graphs, and pie charts.			
			Organize and represent data to help answer questions.			
	Using data to solve problems	5	Use data to answer questions that go beyond directly reading data displays (e.g., solve problems and perform computations using data, combine data from two or more sources, draw conclusions based on data).			

Component 2: Cognitive Processes		**Recommended % of coverage**	**Descriptors/Indicators**	CS	T	TG
Knowing	Recall	40	Recall definitions, terminology, number properties, units of measurement, geometric properties, and notation			
	Recognize		Recognize numbers, expressions, quantities, and shapes. Recognize entities that are mathematically equivalent (e.g., equivalent familiar fractions, decimals, and percents; different orientations of simple geometric figures).			
	Classify/order		Classify/order numbers, expressions, quantities, and shapes by common properties			
	Compute		Carry out algorithmic procedures with whole numbers, fractions, decimals, and integers			

	Retrieve		Retrieve information from graphs, tables, texts, or other sources			
	Measure		Measure using instruments; and choose appropriate units of measurement.			
Applying	Determine	40	Determine efficient/appropriate operations, strategies, and tools for solving problems for which there are commonly used methods of solution.			
	Model/Represent		Display data in tables or graphs; create equations, inequalities, geometric figures, or diagrams that model problem situations; and generate equivalent representations for a given mathematical entity or relationship.			
	Implement		Implement strategies and operations to solve problems involving familiar mathematical concepts and procedures.			
Reasoning	Analyze	20	Determine, describe, or use relationships among numbers, expressions, quantities, and shapes.			
	Integrate/Synthesize		Link different elements of knowledge, related representations, and procedures to solve problems.			
	Evaluate		Evaluate alternative problem solving strategies and solutions.			
	Draw Conclusions		Make valid inferences on the basis of information and evidence.			
	Generalize		Make statements that represent relationships in more general and more widely applicable terms.			
	Justify		Provide mathematical arguments to support a strategy or solution.			

Component 3: Integrated Technology and Assessment	**Descriptors/Indicators**	CS	T	TG

Technology	Integrate technology such as interactive tools, virtual manipulatives/objects, and dynamic mathematics software in ways that engage students in the Mathematical Practices			
	Include or reference technology that provides opportunities for teachers and/or students to communicate with each other (e.g. websites, discussion groups, webinars).			
	Include opportunities to assess student mathematical understandings and knowledge of procedural skills using technology.			
	Include or reference technology that provides teachers additional tasks for students.			
	Include teacher guidance for the mindful use of embedded technology to support and enhance student learning			
Assessment	Provide strategies for gathering information about students' prior knowledge and background.			
	Provide strategies for teachers to identify common student errors and misconceptions.			
	Assess students at a variety of knowledge levels (e.g., memorization, understanding, reasoning, problem solving).			
	Encourage students to monitor their own progress.			
	Provide opportunities for ongoing review and practice with feedback related to learning concepts, and skills,			
	Provide support for a varied system of on-going formative and summative assessment (formal or informal observations, interviews, surveys, performance assessments, target problems).			

Checklist for Integrated STEM Learning

Consider one unit of learning of Math, Science & Technology offered for students during the same time (ex. Week 12-18 of school year) to answer the following questions

	Standard 1: Context of Learning	+	-
1-1	Provide a context that was interesting for students?		
1-2	Provide a context with a compelling purpose (what, why, and for whom)?		
1-3	Include opportunities for students to apply a design process in partially or completely realistic situations?		
1-4	Engage and motivate students from different backgrounds?		
1-5	Engage students in STEM habits of mind (e.g., systems thinking, creativity)?		
1-6	Provide information about what the STEM disciplines are and what people with STEM careers do at work?		
Areas of Strength			
Areas of Weakness			

	Standard 2: Design Thinking	+	-
2-1	Contain activities that require students to use engineering design processes?		
2-2	Address design elements of problem, background, plan, implement, test, evaluate (or other similar representation of the processes of design)?		
2-3	Allow student opportunities to participate in problem scoping? This includes, but is not limited to, identifying the client and end users' needs, criteria, constraints, and areas where more background is needed (e.g., establishing the need for the content).		

2-4	Contain an engineering challenges that require students to consider criteria, constraints, safety, reliability, risks, alternatives, trade-offs, and/or ethical considerations?		
2-5	Allow students opportunities to learn from failure/past experiences?		
2-6	Allow students to redesign?		
2-7	Allow students to participate in an open-ended engineering design challenge in which they design and assess processes or build and evaluate prototypes/models/solutions?		
Areas of Strength			
Areas of Weakness			

	Standard 3: Investing in Science Concepts	+	-
3-1	Require students to learn, understand, and use fundamental science concepts and/or big ideas of science necessary to solve the engineering challenge?		
3-2	Promote coherent conceptual understanding of science?		
3-3	Provide opportunities to learn and implement different techniques, skills, processes, and tools related to science learning?		
3-4	Allow students to implement science process skills?		
Areas of Strength			
Areas of Weakness			

	Standard 4: Investing in Mathematical Concepts	+	-
4-1	Promote coherent conceptual understanding of science?		

4-2	Include questions for students that require the collection and analysis of data (i.e., questions match the data)?		
4-3	Require students to use the data they collect to justify scientific claims and design decisions? Require students to participate in authentic measurement tasks that link to the science and/or engineering? This might include, but is not limited to, learning how to use measurement tools, thinking about variability in measurements, thinking about sources of error, considering repeatability, and allowing students to develop their own measures and tests.		
4-4	Provide opportunities to learn and implement different techniques, skills, processes, and tools related to mathematics learning?		
Areas of Strength			
Areas of Weakness			

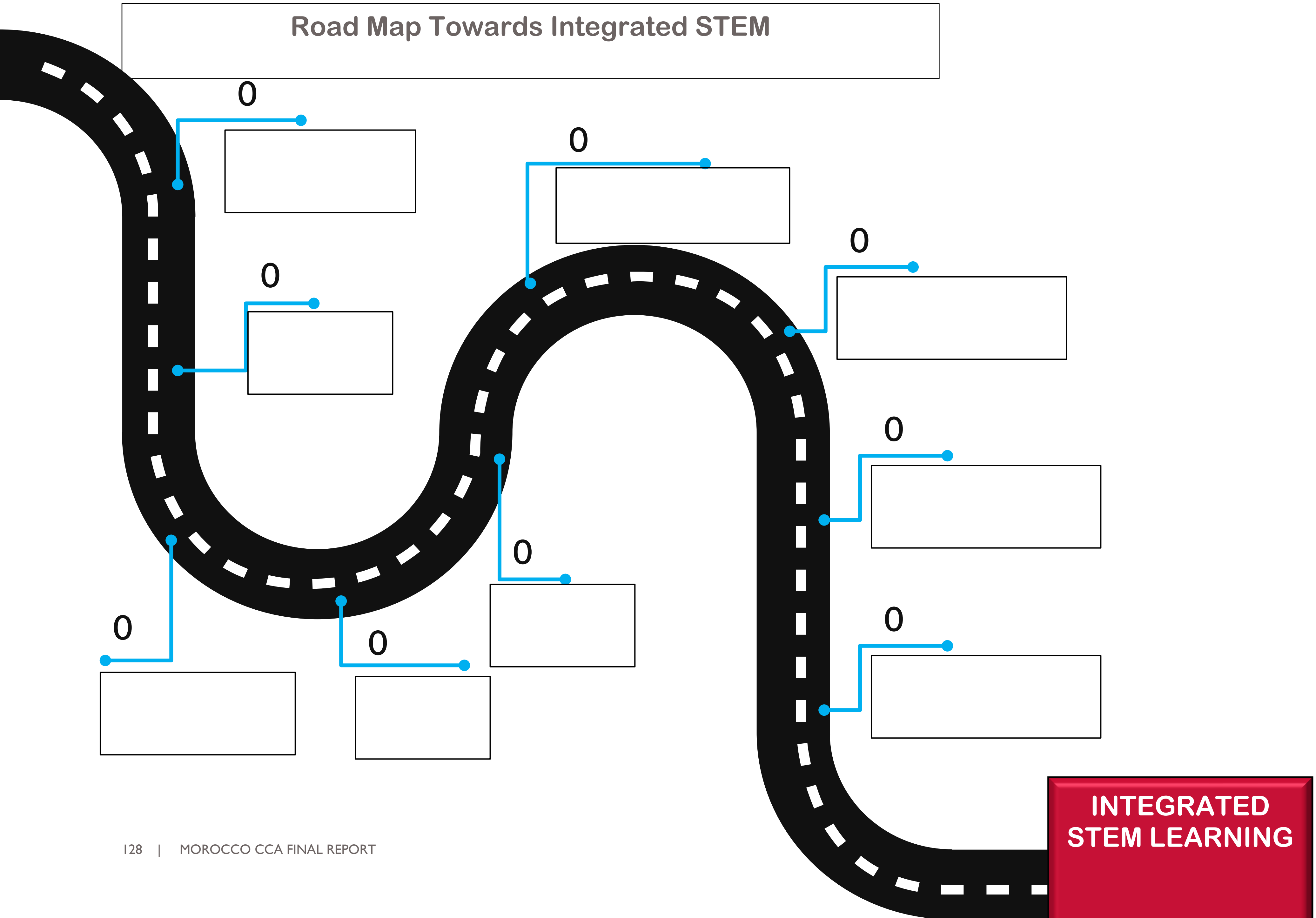
	Standard 5: Instructional Strategies	**+**	**-**
5-1	Lessons and activities are student-centered, minds-on, and hands-on?		
5-2	Contain some activities that require students to collect and analyze information or data before arriving at a solution?		
5-3	Embed evidence-based reasoning as a strategy to connect engineering, science, and mathematics (e.g., data and data analysis provides the evidence for ideas/solutions)?		
5-4	Include strategies for orchestrating discussions to encourage evidence-based dialogue between teams?		
5-5	Involve students in activities that embed STEM ideas to be learned in multiple modes of representation (real-life situations, pictures, verbal symbols, written symbols, manipulatives) with an emphasis on translations within and between modes?		
5-6	Require students to use content-specific digital and non-digital tools to support learning? Digital tools include software, simulations, probes,		

	graphing calculators, web tools, etc. Non-digital tools include protractors, rulers, thermometers, graduated cylinders, spring scales, calipers, etc.		
Areas of Strength			
Areas of Weakness			

	Standard 6: Collaboration & Communication	**+**	**-**
6-1	Require students to collaborate with others?		
6-2	Include opportunities for students to demonstrate individual responsibility while working in a team?		
6-3	Require students to communicate science concepts (e.g., oral, written, or using visual aids such as charts or graphs)?		
6-4	Require students to communicate mathematical thinking (e.g., oral, written, or using visual aids such as charts or graphs)?		
6-5	Require students to communicate engineering thinking/engineering solutions/products (e.g., oral such as presentations to the client, written such as a memo to the client, technical communication, communication to the user, or with visual aids such as schematics)?		
6-6	Include a requirement for evidence-based reasoning in the ways students communicate?		
Areas of Strength			
Areas of Weakness			

	Standard 7: Deployment of ICT	**+**	**-**
7-1	Require students to use technology for research?		

7-2	Require students to use technology for information analysis, problem solving, and/or decision making?		
7-3	Require students to use technology for communication and/or collaboration?		
7-4	Require students to use content-specific tools, software, or simulations (e.g., probes, graphing calculators, Web tools etc.) to support learning?		
Areas of Strength			
Areas of Weakness			


Road Map Towards Integrated STEM
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INTEGRATED STEM LEARNING

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TASK 2 – INCLUSIVE AND ACCESSIBLE EDUCATION RUBRICS

	Rubric Items	Unmet 1	Poorly met 2	Fairly met 3	Highly met 4	Examples from the curriculum and Comments
	Multiple Modes of Representations					
1	Curriculum content: textbooks and teaching materials are presented in different modes: **visual** (i.e. images, visual organizers, color-coded information, graphs, videos), **auditory** (i.e. recordings, audiobooks, films), **hands-on experience** (i.e. experiments, field trips),					
2	The curriculum and associated TLMs are available in different formats that correspond to students needs and characteristics (Braille, large print, sign language).					
3	The instructional (pedagogical) strategies are diverse and deliver the curriculum contents in different forms: visual, auditory, hands-on experience, group and individual activities					
4	Learning activities and trainings contained in **textbooks and materials** are designed and presented in different modes: visual, audio, physical, hands-on activities, group and individual activities, written and verbal, activities					
5	The curriculum and its associated textbooks and materials include activities that provide students with background knowledge on the topic (this is to ensure equality among learners as some might not have enough knowledge that facilitate the learning of a new topic—this problem is usually common among students coming from certain cultural and socio-academic backgrounds and second language learners).					
	Multiple Modes of Responses					
6	Learning activities and trainings provide flexibility in how students can show what they know or have learned: **visual** (written text, drawings and visual mapping, presentation, etc.), **auditory**					

	(discussions, reading, music, signing, reading, reciting), **kinesthetics** (drama, body movement, building and designing objects, experiments, projects					
7	Learning activities and trainings provide opportunities for individual and collaborative: group work					
8	Assessment activities (formative and summative) are designed to assess learning outcomes through different modes of responses/expressions (verbal, visual, auditory, kinaesthetic					
9	Assessment activities provide students with the opportunity to work individually and collaboratively: in group.					
10	The curriculum (particularly the Teacher Guide) provides guidelines and instructions on how to adapt assessments to respond to students' diverse characteristics, needs and backgrounds (like students from different linguistic, cultural backgrounds or students with disabilities)					
	Multiple Modes of Engagement					
11	Lesson activities and trainings encourage different forms of participation and interaction: individual and group					
12	Learning materials and activities in the curriculum encourage students to be fully involved in their own learning (I.e. use of hands-on activities, real-life related activities, play activities, allowing group and individual activities)					
13	The teacher guide provides guidelines on how to engage students who experience difficulties and challenges in learning					
14	The curriculum provides students with opportunities to plan and choose their preferred learning activities.					
15	The curriculum materials and textbooks support peer and collaborative learning					
16	The curriculum (especially the teacher guide) provides guidelines on how to differentiate/adapt learning activities (include different levels of difficulty) to allow the participation of all students and connect to their interests					

17	The curriculum makes connections between the learning content and students' real lives					
18	The curriculum provides opportunities for self-assessment					
Total Score						

ANNEX 2: TASK 2 – TOOLKIT FOR INCLUSIVE EDUCATION

Inclusive Education in Morocco How to Assess New and Existing Curricular Materials for Inclusivity and Accessibility: A Toolkit

Introduction

What is inclusive education?

Inclusivity in education is based on the principle that all children including those who are culturally, linguistically diverse and with or without disabilities are taught in the same schools and classrooms. In inclusive classrooms resources are consolidated as children learn to work together. This creates an atmosphere that promotes cooperation and acceptance of people with disabilities and extends from school to more widely in society. It is the responsibility of a national education system to ensure that all students receive free and appropriate public education while they are provided with equal educational opportunities for learning, growth, and development. In an inclusive education system, all classrooms must be equipped with the necessary support, both human and material, to ensure that children's educational needs are met so that they can be successful in their learning. This includes trained teachers who know how to teach from appropriate universally-designed curricula, as well as low, medium, and high-tech assistive technology. Parent-school-community collaboration is also a feature of exemplary inclusive education systems.

UNICEF (2020) views inclusive education as the "most effective way to give all children a fair chance to go to school, and learn and develop the skills they need to thrive." It supports that inclusive education requires all children, those with and without disabilities, and those from all culturally and linguistically diverse backgrounds – especially celebrating and valuing those who have historically been excluded from educational and career opportunities – to learn in the same schools and classrooms, and to be provided the same educational opportunities and that the contributions. (https://www.unicef.org/education/inclusive-education).

According to USAID (2018, pg.1-2), "Inclusive education means having one inclusive system of education for all students, at all levels, (early childhood, primary, secondary and post-secondary) with the provision of supports to meet the needs of students with disabilities. Inclusion involves a profound cultural shift to ensure that all children, as well as staff, parents and other members of the school community, feel valued, welcomed and respected. It requires a process of systemic reform with changes and modifications in content and materials, teaching methods, approaches, structures, and strategies. Placing students with disabilities within mainstream classes without accompanying structural changes to, for example, organization, curriculum, and teaching and learning strategies does not constitute inclusion.

Successful inclusion means that schools are:

a. Accessible, including sign language environments with signing peers, materials and methods, in particular through national sign language(s), Braille, augmentative and alternative modes of communication, easy-to-read materials and access to information and communication technologies, etc.

b. Based on the principles of universal design so that all children have access to the school building itself, including toilets, spaces for sports, recreation and leisure.

c. Equipped with teachers trained in Universal Design for Learning who are prepared to teach children with diverse learning styles, including those with intellectual disabilities, and where supports and resources are available to the teachers and students for specific needs such as differentiated instruction, orientation skills, Braille, sign language training, hearing loops, speech-to-text, etc."

According to UNICEF (2020), an estimated 93 million children around the world live with disabilities. Despite those great numbers, children with disabilities are often overlooked and are not given equal opportunity to participate in social, economic, and political life and are more likely to be out of school, especially girls with disabilities. This lack of equal access to education and workforce development can be attributed to many factors such as the lack of appropriate education policies and resources, lack of accurate population data on disability, stigma and discrimination around disability, and lack of knowledge on how to make school and work environments universally accessible and inclusive (USAID, 2018).

What does inclusive education look like in Morocco?

The Government of Morocco (GoM) considers the rights of people with special needs and those with disabilities a priority in developing social, educational, and other policies that promote equal opportunity and participation of those groups of people in all aspects of human activity. As one of the foundational rights of individuals, education paves the road to a meaningful, independent, and fulfilling personal, social, and career life. The GoM has accordingly developed integrated policies that can be translated into educational programs and has taken a number of actions included training education ministry officials, teachers, inspectors, and curriculum developers on best practices for inclusive education.

Supporting this notion, Morocco's Ministry of National Education, Vocational Training, Higher Education, and Scientific Research (MOE) embarked in multiple efforts to improve the education of learners with disabilities in the country. The MOE instituted Inclusive Education (IE) for all as one of its major goals within the Framework of the Strategic Vision of the Reform 2015-2030. In a policy document titled *Frame of Reference of Inclusive Education for Children with Disabilities*, [145] the MOE outlines the importance of professionalizing the teaching profession and the impact this has on delivering pedagogically appropriate instruction and assessment that meets the individual learning and socio-emotional needs of all children. In addition, the MOE emphasizes the importance of inclusive education and its principles as a means to give all children the opportunity to enjoy the right to free, appropriate, public, and non-discriminatory education. The MOE views inclusive education in Morocco as community project with all the relevant actors and stakeholders involved because 'Education; as a 'System' is weaved in all aspects of human life and activity and is an integral component of a nation's endeavors towards progress and prosperity. Finally, in the *Frame of Reference of Inclusive Education for Children with Disabilities*, the following types of disability are covered: autism spectrum disorders, mental disorders; cerebral palsy, hearing impairment, visual impairment, and learning disorders.

Since 2015, USAID and the Moroccan MOE have been working together to improve the curriculum in primary schools and to establish inclusive education in Moroccan schools. A recent review of textbooks was initiated to evaluate the extent to which these books are aligned with the new curriculum goals and a systematic analysis and examination of the textbooks and teacher guides for grades 1through 6 for the content areas of French, Arabic, Math, and Science took place. A global team of consultants, including experts from the Moroccan MOE, was assembled to undergo this task. Using a research-based framework and the Universal Design for Learning (UDL) principles, the team undertook a review and analysis of the curriculum.

The Importance of Appropriate Curricula, Materials, Teacher Guides and Continuous Training

[145] 2019.

Inclusion is not an easy task for any educational system, even for the most advanced and well-funded. For educational systems that are now instituting inclusion in their schools this presents both a great challenge and a great opportunity: a great challenge, especially when resources are scarce and the educational system diverse; and a great opportunity, because lessons from other countries and from pilot programs in Morocco can assist in the development of a context appropriate and dynamic inclusive education system with great prospects.

With this understanding, the Moroccan MOE, with the assistance of donors and implementing partners, has been launching various activities to inform the process and progress of inclusion. One of them is the review and analysis of the school textbooks, materials, and teacher guides in all subjects to determine the extent to which it is inclusion friendly, adoptable, and it is based on the UDL principles and practices. A good curriculum coupled with good teaching interventions of skillful teachers will bring the desired learning outcomes and expectations.

Investing in the professional development of teachers, both pre-service and in-service in good inclusive education practices will empower every teacher to teach all students well, and will improve and modify even imperfect curricula. Training general education teachers on ways to co-plan and co-teach with specialists (special educators, speech pathologists, occupational therapists, counselors, psychologists, social workers, and other experts) is critical when planning inclusion. In addition, collaboration with parents and families must be an important part of the education of children with disabilities in the inclusive classroom. This culture of collaboration with parents' and families' needs to be cultivated from the pre-service years of teacher education and be provided as training component during the continuous in-service teacher professional development. Together with teacher training and inspector training, system flexibility must come together to move from the notion of teaching to the textbook to teaching to all students.

In this Toolkit, the theoretical framework, process, challenges and lessons learned from this experience are presented so that textbook designers, teachers, inspectors, and other educational professionals in Morocco can undertake a review of the curricula they engage with, to ensure the necessary accommodations and modifications to promote inclusive education are reflected in all classrooms across the country.

The Structure and Purpose of the Toolkit

This Toolkit is a practical blueprint for making teaching and learning materials more inclusive and accessible for the diverse population of students in Moroccan schools. This toolkit was developed following a national review of Moroccan curriculum in grades one through six for inclusion and accessibility. However, the audience for this toolkit is envisioned as textbook designers, teachers, inspectors and other stakeholders who can use the guidance and tools herein to review individual subjects, grades, textbooks, teacher guides to ensure inclusivity and accessibility on a smaller scale than the original, national level review for which they were designed.

The national review of curriculum examined national policy, curricular directives and frameworks for inclusive education, including:

1. *Frame of Reference of Inclusive Education for Children with Disabilities* (2019)
2. *Framework of the Strategic Vision of the Reform* 2015-2030

Whereas this toolkit targets teaching and learning materials – existing textbooks and teacher guides (or the development of new iterations of these materials). These curricular materials include documentation of expected learning outcomes, teaching and learning strategies, and assessment techniques, which can be assessed using the same theoretical frameworks and tools developed for the national review.

Guiding Assumptions

There are several assumptions that form the basis of the curriculum review team's understanding of inclusive curriculum and inclusive education. These assumptions guided both the curriculum review process and the design of the review rubrics and tools.

These assumptions view inclusive education as:

1. A process that helps overcome barriers limiting the presence, participation and achievements of all learners.
2. A wholistic approach that guides the educational policies and practices.
3. An ongoing process to find more effective ways of responding to students' diverse needs and backgrounds and identify and remove barriers that could potentially impede students' ability to learn and undermine equity in curriculum delivery.
4. An approach that, while benefiting all students as it improves the quality of the curriculum delivery, focuses on those groups of students who can be at risk of exclusion or marginalization due to their particular physical, cognitive, linguistic, demographic gender, or socio-economic characteristics.

Theoretical Foundations

Several prominent frameworks grounded the national review and guidance put forth in this toolkit. Each is detailed below as it applies to how it can aide a review of curriculum materials for inclusiveness.

I. Universal Design for Learning (UDL)

Principally, Universal Design for Learning (UDL) principles are central to any review for inclusivity and accessibility. *Why Universal Design for Learning?* Universal Design for Learning is a framework that seeks to improve and optimize teaching and learning for all students based on scientific principles on how humans learn. This framework offers concrete suggestions that can be applied to any curriculum, and guide reviewers to ensure that all learners can access and participate in meaningful, challenging learning opportunities. The framework is designed to address the: "why?," "what?," "how?," questions about student learning. For example: The *Why of Learning* asks the question, "What motivates students to learn? What are their interests?" The *What of Learning* asks the question. "How can the content be presented to maximize how learners perceive and comprehend the information?" This is where students with a variety of disabilities benefit as well as those with cultural, or linguistic differences. The *How of Learning* asks the question, "How can students be directed to express what they are learning in ways optimize their learning experience." (udlguidelines.cast.org).

There are three UDL principles:

Modes of Presentation: This looks at the way information is displayed and presented to students. Is it visual, auditory, uses models and manipulatives? Does it engage background knowledge, symbols, charts? Does it highlight patterns, organize details, or summarize main ideas?

Modes of Expression and Response: Do the teaching materials allow physical movement, various ways to respond, access to tools and assistive technologies? Do they use models that gradually build independence through practice, assessment, and repetition? Does it allow for scaffolding, goal-setting, and developing and formulating strategies?

Modes of Multiple Means of Engagement: Do the learning materials seek to engage the students' interest, provide relevance and authenticity and minimize threats and distractions? Do they help students with strategies for coping and self-assessment?

II. Multiculturalism

The principle of multiculturalism acknowledges that while modern societies today are tied together by shared nationalism, individuals and groups within societies are not homogenous. All countries include immigrants, displaced people, and marginalized groups. In order to create a society where all citizens are respected and have equal rights, governments recognize that the national education system should reflect the contributions and achievements of all people in the society. Thus, attempts are made to include contributions and achievements of all types of peoples in history books, literature and art. It is projected that by adjusting the curriculum to include significant accomplishments of all people groups, all people, especially those who have been historically marginalized, will be treated more fairly and prejudices will be dismantled.

A Culturally Inclusive Curriculum includes:

- Content that accurately represents contributions from all groups.
- Content that avoids language bias and stereotypes.
- Content that reflects a variety of perspectives not just from the main character or "hero."
- Content that allows open discussion of oppression in any form- racial, sexual, religious
- Content that values different learning styles and perspectives in the classroom.

III. Gender and Disability

The principle of gender and disability in education contends that when all members of a society are given equal opportunities to receive a comprehensive education the whole of society benefits. Therefore, when reviewing TLMs, it is important to look at the frequency of representation of both genders and people with disabilities, the occurrence of both genders and people with disabilities in illustrations, the language that is used to describe them, and roles assigned to them.

A Gender and Disability Inclusive Curriculum demonstrates equal frequency and representation, which in practice includes:

- Illustrations that show boys and girls involved equally in physical and academic activities.
- Illustrations that depict both genders in roles like police, doctors, lawyers, teachers.
- Illustrations that depict females in leadership/decision-making roles as well as males service/supportive roles.
- Textbooks that use equitable language.
- Pronouns that are used with equal frequency. The equivalent of sportsman/ sportswoman, postman/postwoman, host/hostess should be reoccurring themes.
- Person first language is used to talk about people with disabilities, instead of "the deaf girl,"- use the girl with a hearing aid, "the handicapped man," use -the man in a wheelchair.
- People with disabilities are depicted as capable, independent, and making contributions.

Guiding Questions

Regardless of the scale of review, from national level to a review of specific textbooks and teacher guides, there are two important research questions that should guide reviews for inclusivity and accessibility based on the theoretical frameworks detailed above. These questions help to determine the extent to which TLMs materials meet the needs of all children and they are aligned with the principles and practices of inclusive education. The review rubrics detailed in the next section are organized to answer these questions, and therefore assess curricular adherence to best practices in inclusivity and accessible education.

Question #1

In the teaching and learning materials you want to review, how do the TLM (teaching/learning strategies, learning content, activities, etc. align with the UDL framework?

a. How do the TLM's align with the UDL principle: multiple modes of representation?
b. How do TLM's align with the UDL principle: multiple modes of expression and response?
c. How do the TLM's align with the UDL principle of multiple modes of engagement?

Question #2

In the teaching and learning materials you want to review, how do the TLM's promote equity and inclusion for all students considering the diversity of the Moroccan student population (I.e. students with disabilities, female students, cultural minorities, second language learners)?

d. How do the TLM's align with the principles of multicultural education?
e. How do the TLM's align with equity and equality principles for gender and disability?

Utilization of Rubrics for Curriculum Analysis

To understand the extent to which curricular materials respond to the guiding questions, the review team collaboratively developed review tools (rubrics) with criteria based on global frameworks and best practices: UDL, multicultural, gender and equity that were tailored to the Moroccan context. The following rubrics examine how children with disabilities, gender and multicultural education are represented, and how well the teaching and learning materials are aligned with UDL principles.

The UDL Curriculum Alignment Rubric

The UDL rubric (Annex 1) was designed into three sections, matching the three multi mode approaches within UDL. Each consist of criteria designed to assess the extent to which the best practices for that element is reflected in the materials under review. [146] The rubric operates on a scale of 1-4 to evaluate curriculum materials. With (1) meaning no alignment and (4) meaning high alignment.

- Multi Modes of Presentation

Curriculum content: textbooks and teaching materials are presented in different modes: **visual** (i.e., images, visual organizers, color-coded information, graphs, videos), **auditory** (i.e., recordings, audiobooks, films), **hands-on experience** (i.e., experiments, field trips).
The curriculum and associated TLMs are available in different formats that correspond to students needs and characteristics (Braille, large print, sign language).
The instructional (pedagogical) strategies are diverse and deliver the curriculum contents in different forms: visual, auditory, hands-on experience, group and individual activities.
Learning activities and trainings contained in **textbooks and materials** are designed and presented in different modes: visual, audio, physical, hands-on activities, group and individual activities, written and verbal, activities.
The curriculum and its associated textbooks and materials include activities that provide students with background knowledge on the topic (this is to ensure equality among learners as some might not have enough knowledge that facilitate the learning of a new topic—this problem is usually common among students coming from certain cultural and socio-academic backgrounds and second language learners).

- Multi Modes of Expression

[146] Hall et al, 2016
Rao & Meo, 2016;
Rose, D. H., Harbour, W. S., Johnston, C. S., Daley, S. G., & Abarbanell, L. (2006). Universal Rose, D. H., Harbour.
UNICEF, 2014

Learning activities and trainings provide flexibility in how students can show what they know or have learned: **visual** (written text, drawings and visual mapping, presentation, etc.), **auditory** (discussions, reading, music, signing, reading, reciting), **kinesthetics** (drama, body movement, building and designing objects, experiments, projects.
Learning activities and trainings provide opportunities for individual and collaborative group work.
Assessment activities (formative and summative) are designed to assess learning outcomes through different modes of responses/expressions (verbal, visual, auditory, kinaesthetic.
Assessment activities provide students with the opportunity to work individually and collaboratively: in group.
The curriculum (particularly the Teacher Guide) provides guidelines and instructions on how to adapt assessments to respond to students' diverse characteristics, needs and backgrounds (like students from different linguistic, cultural backgrounds or students with disabilities).

- Multi Modes of Engagement

Lesson activities and trainings encourage different forms of participation and interaction: individual and group
Learning materials and activities in the curriculum encourage students to be fully involved in their own learning (i.e., use of hands-on activities, real-life related activities, play activities, allowing group and individual activities)
The teacher guide provides guidelines on how to engage students who experience difficulties and challenges in learning.
The curriculum provides students with opportunities to plan and choose their preferred learning activities.
The curriculum materials and textbooks support peer and collaborative learning
The curriculum (especially the teacher guide) provides guidelines on how to differentiate/adapt learning activities (include different levels of difficulty) to allow the participation of all students and connect to their interests.
The curriculum makes connections between the learning content and students' real lives.
The curriculum provides opportunities for self-assessment.

The Equity and Diversity Review Rubric

The EDRR was used to evaluate the extent to which the curriculum aligns with principles and practices of multicultural, [147] gender, [148] and disability education. [149] A careful review of current literature suggests the following as best practices and recommendations for inclusive curriculum design:

1. Whether there is fair representation of gender, disability and ethnic/social groups in the curriculum characters and content.
2. The extent to which the curriculum provides guidelines for teachers on how to adapt the curriculum to meet all students' needs.
3. The extent to which resources (technology, teachers, creative assessments) are available to support students who need extra help. This could include students with special needs as well as whose first language is not Arabic or who are coming from a low socio-economic background with less family support.

More specifically, there are three categories of criteria incorporated into the EDRR Rubric: multicultural, gender, and disability education. Each category includes criteria that enables an assessment

[147] Demir & Yurdakul, 2014; Banks, 2016; USAID, 2015
[148] Demir & Yurdakul, 2014; Hey, 2010; Simon & Terhile, 2014; USAID, 2015.
[149] Hehir et al, 2016; Mara & Mara, 2012 ; Tichá et al, 2018; USAID, 2015, p.9.

of the extent to which these key principles and practices are reflected in curricular materials. The same 1 to 4 scale used to assess for UDL is also applied to the EDRR rubric.

- Multicultural Education

The curriculum characters are representative or reflective of the cultural, social, linguistic, and demographic diversity of Morocco.
The curriculum content is reflective of the cultural, social, linguistic, and demographic diversity of the Moroccan society by providing examples, texts, or lessons that show and discuss this diversity in all its various and multiple forms.
The Teacher Guide provides alternative options and guidance on how to support second language learners (providing extra time, vocabulary maps, support during class, etc
Content in the curriculum presents historical events or cultural and social components that enable learners to understand the experiences and characteristics of the different cultural, social and language groups of society.
The curriculum encourages students to appreciate/ respect different ideas and accept different views.

- Gender

Curriculum allows for diverse gender representations and avoids gender stereotypes in terms of the characters represented in the curriculum, (i.e., a female engineer, male teacher, or nurse… etc).
Curriculum includes examples/activities suitable for both genders (male and female students can do them without prejudice based on gender abilities).
The language used in the curriculum explicitly addresses both genders.
In the curriculum, both genders are presented as being equal in terms of abilities, skills, and social/ professional expectations. (for example; it avoids presenting men as always in science domains and women in fields related more to human sciences, men in position of leadership and women as mother and housewife; men always provide solutions and make decisions while women are presented as dependant on their guidance).
The curriculum content captures the roles, experiences, challenges, and contributions of both genders to the society through including lessons or information about men and women scientists, writers, researchers or men and women who had great responsibilities and contributions in building their society).

- Education for Children with Disabilities

Students with disabilities have access to learning and assistive tools (Braille printed materials, audiotapes, models, and tactile object).
Curriculum, particularly Teacher Guide, provides guidelines for how to adapt/differentiate the learning content and activities for students who have disabilities (giving more time, providing more support, breaking down the activity, giving more instruction and guidance, designing alternative activities).
Curriculum provides guidelines for how to adapt/differentiate the assessment for those students who have disabilities (extending test time, providing more support, breaking down the activity, giving more instruction and guidance, designing alternative activity, administering the test in a quiet room, giving frequent breaks during exam, etc.)
Curriculum encourages the development of positive attitudes toward disability through curriculum characters (are there characters who have disability in the curriculum?) and capturing the roles, experiences, challenges, and contributions of people with disabilities to the society.

Language used to describe individuals with disabilities promotes a positive image of the person and does not use any negative stereotypes or labels.
When people with disabilities are mentioned, "person-first" language is used (i.e., people with disabilities, "a girl who is blind" instead of "a blind girl" or "disabled").

Final points of guidance for conducting a review of specific curricular materials using the UDL and EDRR Rubrics.

For inspectors and teachers

One way to utilize the UDL and EDRR Rubrics is for teachers working in the same grade or subject review their TML's using the rubric and then comparing their findings. Collaboration promotes understanding of the standards set by the rubrics and discussion between colleagues helps them to modify the TML to meet UDL and EDRR standards. Inspectors could play a critical role in helping to support teachers in collaboratively working to improve their use of teaching and learning materials. In addition, these rubrics could also be applied to assessing one's classroom practices, for instance, a self-assessment by a teacher or an inspector's appraisal of classroom practices and materials available to teachers and learners in classroom settings.

For curriculum designers and textbook publishers

The rubrics can be a guide to bring textbooks up to international standards. Those developing curricular materials are encouraged to work collaboratively, scoring materials individually and then discussing findings together before finalizing any new materials for publication. Including those who are actually using the teaching and learning materials (teachers and students) in the review process and subsequent discussion can help to ensure multiple perspectives are incorporated as well as best practices as reflected in the rubrics.

Additional Resources

Guidelines for Universal Design Principles

http://www.cast.org/impact/universal-design-for-learning-udl
http://universaldesign.ie/What-is-Universal-Design/The-7-Principles/
https://www.access-board.gov/guidelines-and-standards/communications-and-it/26-255-guidelines/825-principles-of-universal-design

Guidelines and Resources for Principles and Practices of Multicultural Education

https://www.edutopia.org/blog/preparing-cultural-diversity-resources-teachers
https://www.wikihow.com/Create-a-Culturally-Diverse-Classroom
https://www.studiesweekly.com/blog/multicultural-curriculum/

Guidelines and Resources for Principles and Practices of Gender and Disability

http://awe.asn.au/drupal/sites/default/files/AWE-Gender-and-Education-Guidelines-and-Checklists.pdf
https://www.irex.org/resource/creating-supportive-learning-environments-girls-and-boys-guide-educators
https://www.col.org/programmes/open-schooling/gender-guidelines-sri-lanka-open-school-system

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ANNEX 4: STUDY TEAM

Table 4: Study Teams

Role	Curriculum Alignment (Reading) – Task 1a	Curriculum Alignment (STEM) – Task 1b	Inclusive Education – Task 2
Team Leader	Amy Porter	Amy Porter	Amy Porter
Lead Facilitator	Hanada Taha	Norma Ghamrawi	Eirini Gouleta
Lead Curriculum Reviewer	Kouider Mokhtari	Iman Chahine	Muna Amr
(local) Co-facilitator & co-reviewers	Khadija Saoudi	Khadija Saoudi	Janet Rachidi
MOE staff – 5-8 participants/ curriculum reviewers	Abdossalam Jaouhari	Ali Allouch	Aicha Hanaoui
	Ahmed Outizzgui	Abdelkrim El Hiani	Larbi Errbah
	Ali Aitouchen	Abdelghani Slimani	Hassan Charai
	Mohammed Amarch	Said El Jamali	Aicha Hanawi
	Btihaj El Hamdouni	Amina Belhaj	Rabha Kissani
		Yassin Bouhri	Boukili Mohammed Anouar
		Btihaj El Hamdouni	
		Abdelkrim Smaili	