

2021

IMPLEMENTATION OF FORMATIVE ASSESSMENT

IMPLEMENTATION OF FORMATIVE ASSESSMENT

Researchers

Dr Sanaa Shehayeb

Dr Tony Al Zaouk

Dr Raymond Bou Nader

Samia abou Hamad

Rana Abdallah

Subject Matter Experts

Samer Siefeldeen

Sayde Al Ahmar

Coordinators of the Project and Researchers

Yvonne El Feghaly

Samer Siefeldeen

List of Tables

Table 1: indicators for evaluation	14
Table 2: Types of Classroom Questions.....	19
Table 3: Questions targeting Students' Affective and Cognitive Abilities	21
Table 4: Distribution of schools based on location and language	33
Table 5: Main descriptive statistics	37
Table 6: Paired samples T-test general results	43

List of Figures

Figure 1: Arabic test results	39
Figure 2: Mathematics test results	40
Figure 3: Types of assessment	46
Figure 4: Zone of proximal development	47

List of Acronyms

ABEGS	Arab Bureau of Education for the Gulf States
ARG	Assessment Reform Group in UK
CRDP	Centre de Recherche et de Développement
DLI	Disbursement Linked Indicators
EGRA	Early Grade Reading Assessments
ICT	Information and communications technology
IRF	Initiation Response Feedback
MEHE	Ministry of Education and Higher Education
NSLAF	National Student Learning Assessment Framework
OECD	Organization for Economic Co-operation and Development
QITABI	Quality Instruction Towards Access and Basic
S2R2	Reaching All Children with Education in Lebanon Support Project
SPSS	Statistical Package for the Social Science
UAE	United Arab of Emirates
UK	United Kingdom
UNRWA	United Nations Relief and Works Agency for Palestine Refugees

Contents

List of Tables	2
List of Figures	2
List of Acronyms	2
Introduction	5
Literature Review	7
Historical Background	7
Summative and Formative Assessments	8
<i>Summative Assessment</i>	8
<i>Formative Assessment in western Countries</i>	9
<i>Formative Assessment in Arab Countries</i>	10
<i>Assessment in Lebanon</i>	13
Roles of Formative Assessment	16
Models of Formative Assessments	16
<i>Black Wiliam Model</i>	16
<i>Torrance and Pryor Model</i>	17
<i>Cowie and Bell Model</i>	17
<i>Ruiz-Primo and Furtak model</i>	17
Quality of questioning	18
<i>Teachers' Questions</i>	18
<i>Students' Questions</i>	23
Formative Assessment and Higher Order Thinking	23
Formative Assessment and Change in Mindset	24
National Formative Assessment Framework	25
Definition of Formative Assessment	25
Role of Formative Assessment	25
Techniques for Effective Formative Assessment	27
Types of Formative Assessment	28
Informal formative assessment tools	28
Formal formative assessments tools	29
Formative Assessment in e-learning	29
Related Studies	31
Implementation	32
Research Design	32

Sampling methodology	32
Process	34
<i>Phase 1:</i>	34
<i>Phase 2:</i>	35
Results comparisons/hypothesis:	37
Interpretation of the results	41
Conclusion	41
Appendix	43
Glossary of Terms	45
Bibliography	48

Introduction

In Lebanon, there has been great progress in reaching increased enrollment in schools, especially in primary education. It is worth noting that, in the academic year 2015-2016, enrollment in public education increased 11 000 students than the previous year. The Center of Education for Research and Development in Lebanon (CRDP) and the General Directorate of Education are assiduous in delivering quality education services and learning environments throughout the continuum of formal or non-formal schooling pathways to ensure meaningful and grade-appropriate learning for children and youth. In this sense, interventions are continuously designed to meet this goal. (United Nations, 2017)

The S2R2 program will help expand access to schools for all children in Lebanon, with an increased focus on improving the quality and inclusiveness of the teaching and learning environment, and on strengthening the national education system, its policies, planning, and monitoring capacities. S2R2 strongly focuses on the quality of education. MEHE is committed to improving the curriculum, as well as the quality of teaching, the learning environment, and learning materials. MEHE's initiatives will include formative assessments at schools; student support program; the provision of psychosocial and academic counselors to give teachers and schools guidance on performance (World bank, 2016). CRDP, under the tutelage of the Minister of Education, is responsible for informing and supporting improvements in education quality through, among other tasks, conducting educational research and national educational statistics, reforming the national curriculum, strategic planning nationwide, and providing in-service training to education staff.

MEHE is committed to reforms that will develop a modern, effective and coherent school system in Lebanon and CRDP is working on a new curriculum framework. A key part of these reforms is introducing a National Student Learning Assessment Framework (NSLAF). The NSLAF sets out a plan to provide a coherent framework of assessment of students in Lebanon (CRDP, 2020) one of the main parts of the NSLAF targeted the formative assessment and its important role in education.

The formative assessment framework has been developed by CRDP under the 4th component of the S2R2 program, based on this framework, Mathematics, and Arabic digital

sample lessons were authored and designed to inform teachers' instructions and support them in scaffolding students according to their performance.

CRDP has recommended the implementation of the formative assessment process to test the effect of using formative assessment strategies on the achievement of grade 3 students in Mathematics and Arabic.

Literature Review

Historical Background

Formative assessment was first referred to as formative evaluation by Scriven in 1967. He was the first to distinguish between formative and summative evaluation. Although he was in favor of summative evaluation, he insisted on the role of both evaluations in curriculum development (Roos & Hamilton, 2004).

Bloom suggested the distinction between evaluation and assessment by outlining a specific instructional strategy that makes use of feedback and corrective procedures to reach what he named as “mastery learning”. He insisted on the idea that feedback alone does not play a major role in improving students’ learning if it was not associated with convenient correctives that take into consideration individual differences among students (Guskey, 2003).

Scriven considered summative evaluation as an assessment of whether the object being evaluated met the stated goals. Bloom elaborated on Scriven’s definition by highlighting the role of summative evaluation in raising judgments about learning and individual students at the end of a course or a program. This definition, however, was contrasted by the role of formative evaluation in which Bloom emphasized the systematic process of curriculum construction, teaching and learning (Cizek, 2010)

New characteristics were added to formative assessment through its development. The most important of these characteristics is the abolishment of grades and other accountability consequences, concentration on strengths and weaknesses and areas of improvement which help teachers in instructional planning. Other characteristics stress the idea that formative assessment is student centered. Large scale application of formative assessment is also not recommended due to the difficulty of detecting individual strengths and weaknesses. It was also referred to as a synonym for feedback which is connected to instructional consequences taking into consideration individual differences (William, 2010).

According to Black and William (2009), assessment is formative when evidence about student achievement is elicited, interpreted and used by teachers, students or peers to make decisions about next steps in instruction that would be better than decisions made if formative

assessment was not used. It should be carefully designed to check whether what has been taught has been learned. This is done through constant readings about where students are. Thus, they emphasized three keys for instructional processes: establishing where the students are in their learning, establishing where they are going and establishing what needs to be done to get them there.

Formative assessment was also named “Assessment for learning” which occurs throughout the learning process. It is interactive, with teachers aligning instruction, identifying particular learning needs of students or groups selecting and adapting materials and resources, creating differentiated teaching strategies and learning opportunities for helping individual students move forward in their learning, providing immediate feedback and direction to students and most of all enhancing motivation and commitment (Earl, Rethinking Classroom Assessment with Purpose in Mind, 2006).

Summative and Formative Assessments

In this section, a review of assessments in several countries will be presented. The country’s perception of formative assessments and practices are highlighted.

Summative Assessment

Summative assessment is a method of evaluation used to test how well a student has performed over time and at variety of tasks. It is usually done at the end of a unit or grading period. The results are expressed symbolically as marks or letter grades. Feedback from summative assessment is communicated with students and their parents in the form of grades with little direction for improvement. It does not specify the gaps in a particular objective but rather achievement as a whole (Earl, 2003).

Educators generally rely on two forms of summative assessment: teacher constructed and standardized. Teacher-constructed assessment is the most common form of assessment found in classrooms. Teachers cannot refer to standardized assessments all the time. They need to create their own assessments relevant to the learning goals and to the content under study. Summative assessments can provide objective data for appraising student performance, but it is vulnerable to bias. Standardized assessment is designed to overcome many of the biases that can taint teacher-constructed tools, but this form of assessment has its own limitations. Both types of summative

assessment have a place in an effective education system, but for maximum positive effects they should be employed to meet the needs for which they were designed.

Many countries in the world implemented educational reforms in assessment. The outcomes of these assessment reforms were focused on summative evaluation, issues of accountability and the readiness of the teachers for the change necessitated by the assessment reforms. The dominating general belief is that summative tests are the best vehicle to raise students' performance. However, there was another point of view focusing on teacher quality and their capacity to use assessment as central to learning since it is the most effective way to improve students' performance (Berry, 2011).

Formative Assessment in western Countries

Black and William, two British professors based their research on formative assessment. They incorporated a wide variety of studies related to the use of assessment to improve teaching and learning ranging from studies of mastery learning to those involving teachers' classroom assessment practices and use of feedback, and student engagement in self-assessment. The researchers concluded that formative assessment had an effect size of between .4 and .7 on standardized tests, making it demonstrably one of the most effective educational interventions in practice, particularly for low achieving students. They argued that the feedback to close the gap between where students were and a given benchmark or goal was the critical feature of formative assessment and posed social context and student empowerment as key considerations in the formative assessment process. The Black and William analysis echoed key elements that are essential to the formative assessment process. The elements are clear learning goals, information about the present state of the student and action to close to gap between the student's present state and the learning goals (Black & William, 2006).

New Zealand schools stressed the importance of professional development for teachers in the progression of evidence-based learning. A coordinator should observe the classes and provide teachers with feedback on improving classroom assessment. The curriculum reform included the importance of assessment practices which should identify students who are not achieving or are at risk of not achieving, or have special needs. In this sense, they are stressing the need for formative assessment that respects students' knowledge and ability to learn in which they feel safe, free and

responsible for their own learning. Parents as well as students are involved in the process of formative assessment. (ERO, 2018)

The formative assessment project was implemented in two phases in UK schools. This project entitled as Aifl project “Assessment is for learning” was guided by Vygotsky’s theory of proximal development. They aimed at implementing Afl/ Aal classroom that is the assessment for learning and assessment as learning classroom. They referred to four architectural principles in their curriculum design: 1. coherence; 2. progression; 3. relevance; 4. engagement/motivation and personalization/choice. Coherence refers to the alignment between the intended, implemented and attained curriculum. Progression takes into account depth and breadth of the curriculum, while relevance considers the validity and reliability of the learning tasks with an emphasis on higher order learning. The principle of engagement and motivation is contiguous to personalization and choice and they are essential to the architecture of the curriculum. Assessment should reflect these differences by giving each child increasing opportunities for exercising responsible personal choice (Clark, 2010).

Formative Assessment in Arab Countries

The Arab Countries have had their experiences in formative assessment. These varied from one country to another based on the approaches adopted, the personality of the teacher and the student, the administrative approach, the disciplines concerned, the gained experiences, the educational system as well as the generalities and specificities associated with it. Nevertheless, the Arab countries were affected by the development and evaluation policy of different western countries which made them tackle the formative assessment concept otherwise.

In the curricula developed in Syria, the Ministry of Education emphasized the importance of evaluation in raising the level of the students’ skills in Arabic language, and emphasized in the description of the curriculum in the third grade linking evaluations with the skills of thinking based on expectations and predictions, research and inquiry, problem solving, decision-making, explanations, observations, classifications, comparisons, interpretations, organizing information, application, ranking, while taking into account the individual differences among students.

In Egypt, the Ministry of Education worked on a project called the "National Standards for Instruction " in 2003 and another project for developing quality of education and assessment in Egypt in 2009. What characterized the two Egyptian experiences was the need to build formative

assessment on a democratic basis; based on the freedom of thought of both the teacher and the student, along with all the parties involved. Their feelings should be respected as they are an integral part of their humanity, and this is called the humanitarian aspect of assessment (Ibrahim, 2000).

In the last decades in Algeria, significant deficits have been observed in relation to the modern evaluation principles approach to the curriculum. One of the failures of the expected results in the training on assessment is the teacher failure to take into account the tools of this kind of assessment, such as exercises and activities. This is documented in studies conducted by the Ministry of National Education (Algerian Ministry of Education, 2009). Through repeated trials and focused studies, curricula have been improved to fit the recommendations and fill the gaps, based on account the motives that influence the behavioral drivers, the environmental motives, and the psychological aspects of the needs (Hani, 1999).

In Bahrain, the Ministry of Education linked assessment to the concept of remedial of learning and emphasized its importance. The ministry also commenced its focus on digital empowerment, which has led the teacher to move from the traditional methods of formative assessment to the modern approaches, which together with the components of the advanced vision of education digitization, have been an added value for improving learning (Al-Barsan, 2015).

In Qatar, it was based on the Education Authority of the Supreme Council of Education experience in 2016. The project aim was to link formative assessment with cognitive thinking skills and even beyond along four phases: motivation, modeling and guidance based on observation coupled with self-experience, capacity development and empowering cognitive processes (Supreme Council of Education, 2016).

However, some weaknesses were identified during its application. Accordingly, an evaluation of appropriate factors was used to align this type of evaluation with the curriculum. Examples include: Focusing on teachers' practice, increasing the time allotted for the lessons, breaking down obstacles regarding teachers' objectivity while using formative assessment, and reducing content (Khalifa, 2018). The adopted development criteria were based on the shortcomings listed during traditional practices, most notably: the ineffectiveness of the training courses provided to teachers in relation to their assessment practices, the inadequate approach of assessment practices relative to the varying experience of teachers (Shamerraany, 2017). In spite of implementing the project adopting the McGraw Hill series based on the idea of a targeted

comprehensive assessment between 2006 and 2016, and conducting formative assessment as one of the five fundamentals to success namely: revising conceptual maps according to past experiences, developing a profound balanced content, remedial and variety of instruction, and professional development, the required qualitative shift was not achieved. That was due to the prevailing traditional stereotype assessments, the dominance of memorization and cramming, and neglecting the rest of the components of the educational context that continued to control the evaluation system in the country (Bakheet, 2017).

Considering the standards of the Abu Dhabi education board, it is noticed that it lacks the implemented teaching content that considers the standards, except for the booklets of grade 6 units 2 and 3. The weaknesses revolve around the absence of united standards for evaluation, the imbalance between the linguistic and cognitive skills, and the absence of accuracy in evaluation. For that reason, the recommendation was to treat the gaps by spreading awareness on the importance of formative assessment and its psychological effects on teachers, students and parents (Kazem, 2007), in addition to continuous training and balancing the formative assessment to the learning outcomes (Mouhammad, 2016). Building upon that, UAE was able to develop a document in 2011 that later lead to the change of curriculum in 2016-2017 in which the standards in the teaching content were met (MEHE, 2016).

New curriculum practices encourage a more 'balanced' approach to student assessments whereby 30% to 70% of assessments should be formative (depending on the subject and grade). The country's vision also promises to further reinforce formative practices, by highlighting the central role of feedback in developing student autonomy as self-monitoring. Moreover, teachers in the UAE are increasingly aware of the importance of formative approaches for student learning and development and many are introducing them in their classrooms. However, there is still a need for stronger support to teachers and schools to introduce an effective and balanced assessment culture in the UAE (OECD, Teaching in the United Arab Emirates: Ten Lessons from TALIS, 2020).

Similarly, regarding Iraq and Kurdistan region, formative assessment did not achieve its desired goals due to the interest in the theoretical side at the expense of the practical side - in addition to the influence of external factors - and this is why the role of the teacher was emphasized, working on teacher professional development, and enhancing educational qualifications

(UNESCO, Iraq Office, 2013). Several studies involving experimental designs showed the importance of formative assessment (Atiya and Aboud, 2007).

As for the case of Jordan, it is noticed that formative assessment has been associated with cognitive, emotional and psychological growth which is necessary while supporting students to adapt to their natural and social environment (Khatayba, 19997). With more focus in later studies, formative assessment was linked to the psychological and emotional dimensions (Al-Samir, 1994), and the social dimension (Hamida, 2000)), as well as a balance in the distribution of goals from one class to another (Ashour, 1990), in addition to improving questioning standards to fit the standards (Khowayla, 1990). Recent studies have suggested linking evaluation to real life situations (Jordanian Ministry of Education, 2014).

Despite this striking disparity between a country and the other, there is consensus among many Western and Arab countries regarding the importance of formative assessment in reforming evaluation programs whether from the western point of view recommended by the Assessment Reform Group (ARG) in the UK or from the Arab point of view recommended by the Gulf countries pertaining to reevaluating the assessment programs, especially formative assessment, and activating its role in the teaching and learning experience. There should be an agreement on a frame of reference on the policies and practices of formative assessment regarding the aspirations sought in the 2030 educational program which is a model by itself (ABEGS, 2017). It is necessary to benefit from the latter model using the 21st century skills, and the ongoing developments in the light of the recommendations of Arab and Western conferences and seminars, and in accordance with the adopted disciplines themselves as well as the Arab's actual context.

Assessment in Lebanon

In Lebanon, summative assessment is dominating. Osta (2007) elaborated on the high-stakes Lebanese national exams. They are considered highly important since they are used to evaluate students, teachers and school achievements. In addition, results from national exams are used to promote students from one cycle to another or for their graduation from schools.

The 1997 curriculum required tools of evaluation that are compatible with its principles and methods of teaching. The traditional summative form of testing that permeated the old curriculum would not be fair to the students following the new curriculum in their studies.

Fortunately, the field of evaluation has witnessed a major shift from strict testing tools and procedures to a more humanistic approach.

The Lebanese curricula in 1997 called for facilitated promotion from one class to another in grades one to three. The main implication of this decision is that control over the collection and interpretation of assessment information has shifted from centralized authority towards the classrooms where assessment occurs on a regular basis (Shaaban, 2000). Formative assessments were not tackled exhaustively in Lebanon. However, there were some attempts to implement them through various projects. The assessment guide that emerged in 2000 made a shift in evaluation from grades to indicators that may diagnose the students' weaknesses and misconceptions in certain areas. That is why evaluation was dependent on competencies that were classified among domains which provide information on the area of difficulty that the student is facing. The grades were distributed among domains. Each domain called for competencies. The indicators are evaluated by grades.

Mathematics in cycle one, for example, focused on three domains for students' evaluation which are numbers, operations, measurement and geometry and problem solving (CRDP, 2000). A framework of summative assessment was initially established in 2000 under the decision 2000/م/666 which specified the types of assessments during the school year and at the end of the school year for each of the four cycles of education at the school level in Lebanon. It also tackles the success criteria in those cycles.

As the decision states, students undergo a continuous assessment all through the year deliberated in weekly exams and recitations in addition to three main trimestral tests.

Taking into consideration the first cycle which is our area of interest in this project, the letters A, B, C, D, E, F (أ-ب-ج-د-ه-و) were used as six level indicators for evaluation.

Table 1 below shows the description of every letter as translated from Arabic

Table 1: indicators for evaluation

Symbol	Symbol value	
A	5	Competency attained in several situations
B	4	

C	3	Competency attained in particular limited situations with difficulty of applying it in other situations
D	2	
E	1	Competency partially attained
F	0	Competency not attained

The average for each competency per semester is calculated by using the value for each symbol. The student is promoted to the subsequent class if he or she gets an average letter symbol E "هـ" or above. The student who gets an average of F "و" is the only one who fails. Remedial programs should begin with those who got C "ج" or below.

An amendment for the decision 2000/م/666 was issued with a decision number 2001/م/940 which reconsidered the three trimestral tests and changed them to two semestrial tests only occurring in February and June of each year. Another amendment was issued in 2010 with a decision number 2010/م/688 which considered a passing grade equal or greater than the average equivalent to the letter D "د" on condition that they got an average "D" in languages and mathematics.

It is clear from the above that grades dominated assessment through all the grades and cycles in Lebanon.

An attempt for formative assessment was initiated through the EGRA project in collaboration with Qitabi, which was concerned in students' reading abilities in Arabic. The aim of the project was escalating interventions to support students who are having difficulty in reading. Accordingly, teachers were trained to plan their lessons in order to accommodate students at different reading levels (CRDP, 2015).

The performance of students in summative assessment compared to what extent the discussed elements of formative assessment are accomplished.

Formative assessment is yet to formally be part of the Lebanese curriculum framework

Roles of Formative Assessment

According to Elwood (2006) formative assessment was not widely used as a teacher development program or as part of a large-scale assessment initiative. However, it was more common to find that individual teachers employed formative assessment practices. Elwood claimed that formative assessments were the best resource for educational intervention. Formative assessment creates greater equity of student outcomes, helps students understand their own learning through self and peer assessments.

Fostering motivation and self-regulation are important outcomes of formative assessment and require consideration of the sociocultural context in which assessment and learning are conducted. One leading edge in this arena is Carol Dweck's conception of mindsets, based on her decades of research on motivation. The theory explains how students think about themselves and their abilities—their mindsets—as much as their ability and talent—are critical to their success. Students' mindsets reflect their views of themselves as students, and particularly their theories of the nature of intelligence, and exist on a continuum. (Dweck & Legget, 2000).

Organization for Economic Cooperation and Development (OECD, *Creating Effective Teaching and Learning Environments: Results from Talis, 2009*) issued six key elements that are essential in implementation of formative assessment. The key elements are:

Establishment of a classroom culture that encourages interaction and the use of assessment tools.
Establishment of learning goals, and tracking of individual student progress toward those goals.
Use of varied instruction methods to meet diverse student needs.

1. Use of varied approaches to assessing student understanding.
2. Feedback on student performance and adaptation of instruction to meet identified needs.
3. Active involvement of students in the learning process.

Models of Formative Assessments

Black William Model

Assessments are formative only if they in some way shape the learning of the student or students. In order to accomplish this, the information that the teacher gains during any kind of assessment sequence needs to be interpreted and somehow used to change what might have

normally been done in the absence of such information (William, 2006). Black and Wiliam and colleagues report four main categories of classroom practice that are essential to rich formative assessment: questioning, feedback given to students, peer and self-assessment and use of summative assessments in a formative manner (Black et. Al.)

Torrance and Pryor Model

This model is grounded in socio-constructivist theory where the teachers are responsible of knowing the zone of proximal development of their students in order to organize the convenient scaffolding. Four aspects of formative assessment were emphasized in this model. First, task criteria are communicated to students through conversation. Second, careful questioning strategies should be designed to enhance metacognitive skills. Observation is a third factor in which the teacher gathers information about students and the fourth aspect is feedback to students which can be exploited for scaffolding (Torrance and Pryor, 2001)

Cowie and Bell Model

This model underlines the idea that formative assessment is only formative if it leads to action on the part of the teacher to enhance student learning in some way. The model distinguished between two types of formative assessments, planned and interactive. In the planned type, the teacher should have the initiative to adapt the instructional tasks to fit the students' needs. Three stages are included in the planned type: eliciting students' responses, reflecting on the tasks and then performing actions. In the interactive type, the teacher should know the students' misconceptions and take consequent measures. This type is convenient for technology designed lessons in which the teacher need not to be present in person all the time

Ruiz-Primo and Furtak model

This model of formative assessment focuses on the application of ESRU cycles (Elicit question, Student response, Recognition by teacher of students' needs and Use of information) . This cycle is mainly applied in informal formative assessment. It needs direct feedback from the teacher. In this sense, the teacher may be involved in more than one cycle in the same session.

Quality of questioning

Prior studies have examined the degree of teacher questioning and the level of questioning. Question types identified included: literal questions, which are similar to Bloom's Knowledge level and require recall of facts and meaning; interpretive questions, which are similar to Blooms Comprehension level and ask students to add to an interpretation or explanation; problem situation, which necessitates students to apply knowledge to a new situation and could be considered similar to Bloom's application or analysis level; and affective questions, which include all cases of students being asked to consider their own values, interests, beliefs, or attitudes. While 40% of the class time was found to be spent in teacher-directed questioning, the majority of these questions were at the literal recall level rather than higher order thinking such as interpretation and application, or in reflective questioning addressing the affective domain (Seker & Komur, 2008) Classroom questioning, originally, had a typical sequence: —teacher initiation, student response and feedback (IRF). But, recent research stressed the need to go beyond the standard IRF. First, the questions posed should be critical to the development of students' understanding. Second, the responses elicited should represent student thinking to facilitate teachers' subsequent decision making. Third, the follow-up actions teachers take should be meaningful interventions which move students towards their learning goals (Milawati, 2017).

Classroom questioning is important to help diagnose students' understanding in formative assessment White & Gunstone (1992) Classroom questioning plays the major role in formative assessment. Both teachers' and students' questions are as important in the learning process.

Teachers' Questions

Elstgeet (2001) distinguished between productive and unproductive teacher questions. The latter asks directly about facts or reasons where there are clearly right answers. The former are more useful in helping the children's investigation and thinking, thus encouraging inquiry. There are several types of questions in elementary classes as illustrated in Table 2.

Table 2: Types of Classroom Questions

Type of Questions	Definition and Function	Example	Impact
Open questions	Open-ended questions are framed in such a way that a variety of responses or approaches are possible. Math questions are designed to uncover student understanding and misunderstandings. The responses are used to inform instruction rather than to make evaluative decision. (Small, 2009)	The product of two whole numbers is 96 and their sum is less than 30. What are the possibilities for the two numbers?	They give access to children to explore and solidify mathematical concepts. They help in constructing students' knowledge and motivating them to answer without the fear of providing correct answers
Closed questions	Closed questions when it suggests that there is one right answer.	The product of two whole numbers is 96 and their sum is less than 30. What are the two numbers?	May discourage the students from answering because they are afraid of providing incorrect responses.
Person centered questions	Person-centered questions when the teacher asks the children to provide their own ideas, with no suggestions that there is a right answer, so all the children are encouraged to answer the questions.	<ul style="list-style-type: none"> ▪ What do you think about the same of numbers knowing that they have the same product? 	Motivate students to answer without the fear of providing incorrect responses and just expressing their ideas. They also inform the teacher about the process skills used by the student and give deeper understanding of how the student observes the issue and investigates about it

Subject centered questions	Subject centered questions when the teacher asks students directly to provide the answer, and does not rise questions in the children's mind or arouses the spirit of inquiry in him/her.	What is the product of two numbers whose sum is 10?	These questions do not lead to children expressing their ideas freely or give space to inquiry. Discourage the students to answer because they are afraid of providing incorrect responses.
Pace productive teacher questions.	Attention-focusing questions are asked if the students' observation is superficial and attention fleeting.	▪ Have you noticed the product of two numbers having a constant sum?	Help the children's investigation and thinking, thus encouraging inquiry and engagement.
	Comparison Questions explore similarities and differences between two or more items. The process has three parts: Choosing appropriate characteristics for comparison, identifying similarities and differences among items, using the characteristics, and developing conclusions from the comparison.	▪ Compare two numbers when their product is maximum and their sum is constant.	
	Measuring and counting questions take observation into the quantitative sphere.	Estimate the distance from school to your house.	
	Action questions lead to investigations.	Find two numbers, both greater than 3, whose product is 36.	

	<p>Problem-posing questions whereby students have to use experience or use all what they know about the problem in order to solve it. Also, they will apply their findings in order to show how they have solved the problem.</p>	<p>There are tricycles and bicycles on the road. They are 25 altogether. How many possible tricycles and bicycles could there be? Give 4 possibilities.</p>	<p>These are a challenge for the students by motivating them and mobilizing their curiosity to solve a problem.</p>
--	---	---	---

Questioning in formative assessment may be seen through another angle in which the students' affective and cognitive abilities are stimulated as presented in Table 3.

Table 3: Questions targeting Students' Affective and Cognitive Abilities

Type	Example	Impact
<p>Questions to initiate investigation of children's ideas</p>	<ul style="list-style-type: none"> - Which way (e.g., picture, model, number, sentence) best shows what you know about multiplication? - What evidence would you need to show that your idea works? - What could you do to make it even better? 	<p>Diagnostic These types of questions which fit this case are: attention-focusing questions, measuring and counting questions and comparison questions</p>
<p>Questions for developing ideas</p>	<ul style="list-style-type: none"> - How can you use addition to multiply two numbers? - What evidence would you need to show that your idea works? - What could you do to make it even better? 	<ul style="list-style-type: none"> • Constructing Knowledge • Questions which are used in case the children's ideas seem to require further experience and comparison between things.
<p>Questions for encouraging process skills</p>	<p>Connections: When do we use multiplication in real life?</p> <p>Representations: Can you represent multiplication in a diagram?</p> <p>Communication: Explain, to your classmates, the way you solved the problem.</p>	<p>Exploration and deduction</p>

	Reasoning and proof: Can you develop a pattern for the given sequence? Do,Do, Re , Mi, Do, Do ,...	
Problem solving questions which are used for applying ideas	How can you divide two apples among three children?	

The most important part in questioning is the technique of using the questions in a formative assessment classroom environment. Sequencing of questions and framing of questions during formative assessments play a major role in enhancing students' motivation and developing their higher order thinking skills. Questioning techniques foster students' engagement and take into consideration questions that address individual differences.

Questions targeting the affective domain should take into consideration students' motivation and curiosity for learning by taking into account the following techniques:

- 1- The Concepts of "Wait-Time" and "Think-Time...": Increasing teacher Wait Time and Think Time leads to longer student responses and less "failure to respond". There will be more student-student discourse and student-initiated discourse, less student confusion thus leading to higher achievement.
- 2- Motivating students to answer: Students need to feel they are in control of their own learning processes (autonomy) and that they can execute the task (competence) as well as feel they are respected and cared for by others (relatedness)

Prompting questions: Well-chosen open-ended questions have positive effects in;

- 1- Encouraging critical thinking since they are mainly higher-order questions.
- 2- Handling incorrect answers of the students in a positive way using multi-representations of the concept.
- 3- Encouraging non-volunteers through giving special attention to individual students who are not participating in class discourse.
- 4- Adopting convenient teachers' behavior: shift from teacher- centered to student centered- classrooms.

Students' Questions

Encouraging children to express their questions, including the vague and unspoken ones, is helpful to their learning. The teacher should give students chance to ask questions. It is important that students realize that they can raise questions and answer them for themselves; i.e., investigable questions. These types of questions keep the interaction between child and environment alive, between question and answer. These children who start posing such type of questions and realize that they can answer them have made the best start they can in the process of cognitive development.

The importance of stimulating questions means that the classroom fosters the curiosity from which these questions arise.

Here are some ways of doing it:

- Provide plenty of interesting material for children to explore.
- Ask students to bring their own private materials and objects since students have interest in sharing other children's stuff.
- Set up a question corner or a question of the week activity where there are materials to stimulate inquiry that might be incorporated in class work.
- While introducing new or unusual things to stimulate curiosity, provide the student with familiar material.
- Extend the invitation to the investigable type of questions by regularly asking: "what question would you like to ask about-----?" either orally or in writing on worksheets.
- Resist the temptation as a teacher to do all the question raising.

Formative Assessment and Higher Order Thinking

Feedback on students' performance in class or on tasks enables them to restructure their understanding and this leads to construction of higher level thinking skills. Higher order thinking as defined by Zohar and Dori (2003) is characterized by the analysis, synthesis, and evaluation domains of Bloom's taxonomy as well as cognitive activities such as the constructing of arguments, posing research questions, making comparisons, solving non-algorithmic complex problems, handling controversies, and identifying hidden assumptions. Higher order thinking

involves solving tasks whereby an algorithm has not yet been taught or applying algorithms to unfamiliar contexts. The following task is characterized by novelty, complexity, and creativity.

Formative Assessment and Change in Mindset

The use of formative assessment in guiding instruction requires a change in the mindset of students, teachers, principals and parents. The shift is towards partnering with students in a way that they become responsible for their own learning while teachers assume the role of facilitators. It is essential that technology is used effectively in daily activities

One of the key components of the formative assessment process is setting and sharing clearly defined learning goals which should be classified into a progression of concepts and skills. This will help students build their growth mindset while accepting challenges. Teachers' constructive feedback plays the major role in raising the students' growth mindset which boosts their motivation and engagement in.

National Formative Assessment Framework

Based on development of the notion of formative assessment throughout history and the role it played in raising awareness towards a new conception of assessment which involves a partnership between all the components of the educational process.

Definition of Formative Assessment

Our definition of formative assessment can be stated as follows: Formative assessment is an active learning process through which schools, teachers, students and their parents are engaged through a high technology medium. The teacher is the facilitator of learning and is responsible for creating a convenient classroom climate whereby instant constructive feedback enriches higher order thinking and the students have growth mindsets through which they are held responsible for their own learning.

Formative assessment is sought to be assessment for learning. In this process students learn through assessments and teachers modify instructional tasks according to the students' needs. Through formative assessment and in the case of assessment as learning, higher order thinking skills are promoted. This growth of mindset will lead to higher results in summative assessment.

Role of Formative Assessment

The role adopted for formative assessment requires a fundamental shift in the teachers' beliefs about their role. In a formative assessment– centered classroom, teachers interact more frequently and effectively with students on a day-to-day basis, measuring and promoting their learning. This interaction requires the teacher to step back from the traditional role of information provider and corrector of misconceptions and errors in order to listen to and encourage a range of ideas and problem-solving strategies among students. Class discourse is essential in formative assessment, thus helping students to talk and encouraging them to consider the evidence that supports or challenges their thinking. During such interactions, the teacher is continuously thinking about how to shape instruction to meet the learning needs of students and build a bridge between their initial ideas and the mathematical understandings we want all students to successfully achieve (William, 2010). Formative assessment is the assessment through which feedback from students is interpreted and used to make decisions about the next steps in instruction. Its purpose is for

learning and as learning. It is the key to unlock students', teachers' and parents' engagement (Duckor & Holmberg, 2017). It complements students' growth mindset (Viering, 2016) and supports students' motivation (Cauley & Mcmillan, 2010).

There are five key strategies for formative assessment: sharing learning expectations, questioning, constructive feedback, self-assessment, and peer assessment. Formative assessment can be synchronous or asynchronous: synchronous when the teacher use probes to prime students' thinking and pique their interest in learning through direct contact while it is asynchronous when the feedback is indirect through designing electronic activities supported by a rich medium of feedback (Bennet, 2011).

The following are attributes of formative assessment that teachers should consider when preparing their activities:

- Relevance: Students need to identify the significance of their learning, so they feel their responsibility and ownership for learning.
- Authenticity: The tasks used in formative assessment are directly related to the students' experience in life which render it authentic.
- Autonomy: Students will have the self-initiation and take action to ask questions that are related to their own learning.
- Collaboration: Peer interaction is very important as students will learn from peers' questions. They will also benefit from the class discourse.
- Higher order thinking skills: Students will be able to think at a higher level so they will solve problems related to real life.
- Self-assessment is an important indicator which the students will implement willingly and on their own responsibility. (Bae & Kokka, 2016).
- Productive questions and activities aligned with the curriculum. These questions involve depth of content, level of cognitive skills and complexity of situation.

The questions if carefully planned should target the following areas;

- Motivation of students to answer
- Prompting questions
- Handling incorrect answers of the students

- Encouraging non-volunteers

All of these roles will develop students' growth mindset while promoting motivation and ensuring engagement in the learning process.

They will also make teachers adopt convenient behavior by listening to students and giving them chance to express themselves without interruption.

Techniques for Effective Formative Assessment

There are several techniques that a teacher can implement in order to effectively apply formative assessment:

- Priming—building on background knowledge and creating a formative assessment-rich, equitable classroom culture.
- Posing—asking questions in relation to learning targets across the curriculum. This technique is the most important one.
- Pausing—waiting after powerful questions and rich tasks to encourage more student responses by supporting them to think aloud and use speaking and listening skills related to academic language.
- Probing—deepening discussions, asking for elaborations, and making connections using sentence frames and starters.
- Bouncing—sampling student responses systematically to broaden participation, manage flow of conversation, and gather more “soft data” for instructional use.
- Tagging—describing and recording student responses without judgment in order to motivate students with different styles and needs to approach learning informally.
- Binning—interpreting student responses with a wide range of tools, categorizing misconceptions and “p-prims,” and using classroom generated data; to make instructional decisions more valid and reliable during next steps in the lesson or unit (Duckor & Holmberg, 2017).

Types of Formative Assessment

Formative assessment can be conducted formally or informally and, in both cases, it can be conducted remotely through a computer rich setting.

Informal formative assessment tools

Informal formative assessment takes place when a teacher elicits students' thinking and makes immediate use of this knowledge in instruction. Informal assessments are not data driven rather they are content and performance driven.

There are several tools for informal formative assessment that can be implemented in class and help the teachers keep track of their students' progress.

1. **Observation:** Keep samples of student work in chronological order so that you can identify progress and areas of weakness.
2. **Oral presentations:** Use formal or informal oral presentations depending on the purpose.
3. **Journaling:** Give your students one to three minutes at the end of each day to write about what they have learned and compile all in a journal.
4. **Paper toss:** Ask your students to write questions to each other on pieces of paper.
5. **Four corners:** Label each corner of the room with a different option such as strongly agree, agree, disagree, strongly disagree, or A, B, C, and D. Read a question or statement and have students go to the corner of the room that represents their answer.
6. **Matching/Concentration:** Ask students to take turns turning over two cards trying to match a question card with the correct answer card.
7. **Exit Slips:** Ask students to fill out the card with answers to statements such as: three things I learned, two questions I have, one thing I didn't understand, what I found most interesting.
8. **Demonstration:** Provide the tools to let students show you what they know, explaining the process as they proceed.
9. **Drawing:** Ask students to draw. Drawing is an excellent way for creative, artistic, or kinesthetic students to express what they've learned.
10. **Cross-word puzzle:** Create puzzles with a crossword puzzle maker, using definitions or descriptions as the clues. Correct answers result in a correctly-completed puzzle.

11. Narration: Ask students to explain something in their own words. This requires comprehension of the subject. Using narration is a useful tool to discover what students have learned and identifying areas that need to be covered more thoroughly.
12. Drama: Invite students to act out scenes or create puppet shows from topics they've been studying. This is especially effective for historical events or biographical studies.
13. Student self-evaluation: Use self-evaluation to help students reflect on and assess their own progress (Bales, 2020).

Formal formative assessments tools

There are many tools for formal formative assessment. Some of these are:

1. Discussion and questioning (posed by students and teachers): The teacher uses effective questioning to check students' learning while they are used by students questioning to explore and construct new learning.
2. Quizzes: Are considered as a form of retrieval practice from one session to another.
3. Peer assessment and interaction: Peers provide each other constructive feedback as opposed to grading each other's work with the criteria set by the teacher.
4. Coded feedback: using codes that students comprehend to distinguish between comments that require action and other comments that do not
5. Parents' effective participation: Parents should be aware of the procedure of formative assessment taking place and their role with their children and with the school.

Formative Assessment in e-learning

Formative assessment can be also implemented in e-learning. It can be implemented synchronously and asynchronously. Pachler et al. (2010) used the term formative e-assessment which they defined as "the use of ICT to support the iterative process of gathering and analyzing information about student learning by teachers as well as students and of evaluating it in relation to prior achievement and attainment of intended, as well as unintended learning outcomes" (p. 716). The Pachler et al.'s definition encompasses application of formative assessment in all forms of e-learning environments including the complementary role of ICT in face-to-face settings as well as in blended and online learning settings. In the same vein, we define online formative

assessment as the application of formative assessment within learning online and blended settings where the teacher and students are separated by time and/or space and where a substantial proportion of learning/teaching activities are conducted through web-based ICT.

E-formative assessment demonstrated the need to offer complex and authentic assessment activities that engage the student in decision-making and problem solving that is relevant to their real-world situations. That way, students engage themselves in meaningful ways that enable them to reflect deeply on both their learning processes and outcomes, which subsequently drive them towards metacognitive thinking and self-learning. Metacognitive thinking is associated with enhanced ability to transfer knowledge to new situations. Online formative assessment needs to encourage and promote the student learning experiences through a variety of authentic tasks thus promoting engagement and transferability.

According to Pappas (2015), the teacher should continuously check the goals set at the beginning of a lesson and track students' progress . The teacher should observe the student while completing their online activities assessing the proficiency and skill level of every student; the teacher can meet with the student through one-to-one discussions to talk about their work and relieve their misconceptions, noting that this meeting can be done online. Students should also reflect on their learning and communicate their thoughts and feelings about the concepts of the lesson. Group presentations can be done online also. Peer work and presentations will help the teacher follow their misunderstandings. Self-assessments are also very important in e-learning as they allow students to reflect upon their own learning.

Related Studies

Several studies showed a beneficial impact on students' achievement and conceptual change, either directly or indirectly by enhancing motivation.

Anderson et. al. (2017) conducted a study that examines the effects of teachers' formative classroom practice on student achievement. The teachers who followed a professional development program on formative assessment were 22 grade 4 mathematics teachers in Sweden chosen randomly. The study results showed that, after controlling for pretest scores, the classes in the intervention group significantly outperformed the classes in the control group in a posttest administered one school year after the end of the program. Formative assessment was also found to be a useful pedagogical practice to enhance the teaching of higher order thinking in mathematics. Cheeli (2019) explored the impact of a formative assessment intervention on students' achievements in higher order thinking mathematics pre-test and post-tests. The teachers attended 2-day professional development training on formative assessment. Data were gathered from nine primary schools involving nine teachers and 272 grade 4 students in Botswana. The teachers' experience and reflections supported formative assessment higher-order thinking skills as a strategy to enhance mathematics teaching. The results for this study showed a statistically significant gain in students' achievement in mathematics in the tests that were constituted of higher order thinking items.

Formative research in languages was explored by Al Ahmadi et. al. (2019) . This research investigated whether a formative speaking assessment has a significant impact on students' performance in the summative test. It also tested the effects of monitoring student learning and constructive feedback to improve students' learning. This study shows that formative assessment helped Saudi students to overcome the challenges they face in English speaking test. Moreover, Satar and Yusoff (2019) study reported on the improvement of Arabic language teaching and learning through the implementation of formative assessment. The data was collected through interviews and document analysis of three lower secondary Arabic language teachers. The findings proved that the implementation of a holistic and continuous classroom-based assessment of Arabic language can enhance student achievement in four key language skills namely listening, speaking, reading and writing.

Implementation

Research Design

The main purpose of this study is to determine the effectiveness of formative assessment in mathematics and Arabic language in Lebanon during the year 2019-2020. This study implements experimental, pretest, posttest design. Data gathered was computer-processed using the statistical package for the Social Science (SPSS) Software. Descriptive statistical tools such as frequency count, mean, and standard deviation were employed. On the other hand, t-test was used for inferential tests. All inferential tests were set at 0.05 alpha levels of significance.

Sampling methodology

In this study, and to optimize the selections of the 180 schools, we used the “quota sampling method”, which is a non-probabilistic sampling method, based on logic, common sense, and knowledge of the field. (Py, 2013). Quota sampling is a method of stratified sampling in which the selection within strata is non-random. Selection is normally left to the discretion of the interviewer, and it is this characteristic that destroys any pretensions towards randomness. In our study, and in the vast majority of CRDP’s studies and in order to optimize the selection of the schools, we took the following quotas into consideration: governorates and the school foreign language of instruction (French, English and trilingual). The quotas calculus was based on the school population record published by CRDP in their 2020-2021 statistical bulletin (CRDP,2021)

Concerning the sample size, a sample of 340 schools is normally chosen for a population of 2796 schools (private, semi-private, public and UNRWA), taking into consideration a 5% margin error and 95% confidence interval level. For this study, and in order to answer the specifications of the DLI4, we took the sample of 180 schools only from the public schools’ population.

The choice of the 180 schools is represented in table 4:

Table 4: Distribution of schools based on location and language

Governorates	Foreign language of instruction			Total
	French	English	Trilingual	
Beirut	3	3	1	7
Mont-Lebanon (with Beirut Suburbs)	5	7	0	12
Mont-Lebanon (without Beirut Suburbs)	7	12	1	20
North	35	1	0	36
Beqaa	6	11	1	18
South	3	15	7	25
Nabatiyeh	0	7	10	17
Akkar	31	0	0	31
Baalbek-Hermel	9	4	1	14
Total	99	60	21	180

Process

The process of implementation was divided into 2 phases to control the variables and assure the correct implementation and make sure that all teachers involved are ready for the process and aware of all its steps to ensure a smooth and reliable data collection.

Phase 1:

Training sessions were given to teachers, during which the process of the study was explained.

First training sessions were scheduled before the first phase of implementation. Teachers were divided into groups of 60 (30 schools from which one Mathematics teacher and one Arabic teacher were invited) and Microsoft teams was used for delivering the training.

During these sessions, the research process was explained in details. Expectations and deadlines were set and discussed with trainees.

All teachers showed interest in being part of this research and participated in the discussions. They shared their expectations, limitations and worries which were all clarified by the trainers. The team ensured that all teachers are present and ready to implement the process as planned and the teachers were provided by a hot line to answer their questions by the trainers directly.

The presentation included a timeline in which the trainers explained each step of the first phase in addition to the required work from teachers from delivering the assigned objective to performing the first assessment, grading the papers, and uploading the grades.

After training sessions were done, documents that are related to the first phase of the experiment were shared with teachers. These documents include the first assessment document, the evaluation criteria to be applied so that all teachers follow the same grading schema as well as a protected excel sheet on which grades must be uploaded. The team kept a continuous contact and follow up so that all teachers will be able to deliver the required documents on time. This follow up continued during the grades submission by schools in order to confirm the validity of the data sent.

Phase 2:

The second phase of the implementation started with training sessions. Teachers were divided into groups of 30 teachers. Each group attended a six-hour-session in which the trainers recalled the steps of the implementation through an interactive activity that focused on embedding the “formative assessment” in its steps. Trainers guided teachers to define the formative assessment through a rich discussion about their experiences. All types of formative assessment were displayed and explained in detail. Teachers were very interested in sharing their point of view and exchanging expertise with fellow teachers.

Teachers were then shown the steps of implementing the “formative assessment” in delivering the assigned objective. A demo lesson took place where trainers explained the parts of the lesson that will be covered during the coming phase and focused on all aspects of formative assessment embedded in the lesson.

Deadlines and expectations were discussed and finalized as well.

After training sessions, documents related to the second phase were shared with teachers and implementation took place in classes.

Teachers submitted their grades for the second phase of the implementation and the team confirmed the data through direct contact with each teacher.

The response rate was 100% from all teachers (Mathematics and Arabic) this may have been due to the continuous follow up from the training team and also due to the incentives that were offered to the teachers upon sending evidences of implementation and completing the reports, the pre-test, and the post-test that were all saved by the school administration.

Data collection process:

Good data management requires effective processes for consistent data collection and recording, secure storage, cleansing, transfer (e.g., between secure storage, cleaning, transfer) (e.g., between different types of software used for analysis), effective presentation, and accessibility for audit and use by others. for audit and use by others.

Some of the frequently cited aspects of data quality are:

- Validity: the data measures what they are supposed to measure.
- Reliability: data is measured and collected consistently according to standard definitions and methods; repeated measurements produce the same results.
- Completeness: all data elements are included (according to specified definitions and methods).
- Accuracy: data are sufficiently detailed
- Integrity: data are protected from bias or deliberate manipulation for political or personal political or personal reasons.
- Timeliness: the data are up to date (current) and the information is available on time.

Concerning the data analysis for the questionnaires results, it was done by using SPSS-26, charts were represented using MS-EXCEL.

We should note that our data analysis was divided into two separate sections: the descriptive and the inferential statistics. In the descriptive statistics sections, we have measured the principal statistical indicators defined in the literature review of this study, as well as a frequency analysis for the major questions. On the other hand, in the inferential statistics sections we are going to use statistical tests on our sample in order to answer the research question, the different hypothesis and to try to generalize about the larger population of public schools in Lebanon,

Practically and in order to better understand the overall situation and to answer our hypothesis we will use many statistical indicators as the central tendency characteristics, the dispersion characteristics, shape characteristics etc...

As well, in order to compare the students results in Mathematics and Arabic before and after the formative assessments, and since our scores are normally distributed, we used the paired samples T-test.

Results comparisons/hypothesis:

In our study, and in order to verify if there is a significant improvement of the student's results before and after the formative assessment implementation, and after verifying the normality of our quantitative variables using the Kolmogorov-Smirnov (KS) test of normality, the paired samples T-test was used to compare the means of the different questions in the Arabic and the Mathematics test as well as the total scores of both subject.

The Paired sample t-test or the dependent t-test compares the means between two related groups on the same continuous, dependent variable considering that the variables are normally distributed.

In testing the hypotheses of our research, there are two ways to do this work: either use the test statistic or use the p-value. The latter approach (which is also called the observed significance level) is based on a probability called the *p-value*. Assuming the null hypothesis is true; the p-value is the probability of obtaining a sample result that is at least as unlikely as what is observed (Anderson et al., 2003, p. 348). The current study uses the dependent t-test as a statistical tool and the p-value approach to test the research hypotheses at a maximum significance level of 5% ($\alpha = 0.05$).

The main descriptive statistics results of each question and the total scores are represented in table 5.

Table 5: Main descriptive statistics

Pair	Mean	Std. Deviation	CV
Q1_arabic: phase1/phase 2	2.192/2.249	0.931/0.851	0.42/0.38
Q2_arabic: phase1/phase 2	1.645/1.803	1.027/1.035	0.62/0.57
Q3_arabic: phase1/phase 2	1.269/1.196	0.736/0.727	0.58/0.61
Q4_arabic: phase1/phase 2	4.031/5.283	4.082/4.441	1.01/0.84

Total_arabic: phase1/phase 2	9.138/10.532	5.819/6.238	0.64/0.59
Q1_math: phase1/phase 2	1.31/1.50	0.873/0.780	0.67/0.52
Q2_math: phase1/phase 2	1.67/1.77	0.701/0.596	0.42/0.34
Q3_math: phase1/phase 2	1.29/1.46	0.851/0.800	0.66/0.55
Q4_math: phase1/phase 2	1.24/1.06	0.903/0.908	0.73/0.86
Q5_math: phase1/phase 2	1.30/1.23	0.843/0.821	0.65/0.66
Q6_math: phase1/phase 2	0.90/1.00	0.916/0.858	1.02/0.86
Q7_math: phase1/phase 2	1.13/1.17	0.816/0.826	0.72/0.71
Q8_math: phase1/phase 2	0.93/1.20	0.849/0.836	0.92/0.70
Q9a_math: phase1/phase 2	0.81/0.71	0.856/0.891	1.06/1.25
Q9b_math: phase1/phase 2	0.42/0.41	0.763/0.755	1.81/1.82
Total_math: phase1/phase 2	10.99/11.52	5.823/5.476	0.53/0.48

Two types of hypotheses were formulated i.e. Alternative hypothesis and Null hypothesis for Arabic and Mathematics for the present study. Both the hypotheses were tested with the help of statistical tools.

Null Hypothesis: There will be no statistically significant difference between the experimental group's pre and post administration results on grade 3 students' achievement in Arabic language.

Alternative Hypothesis: There will be a statistically significant difference between the experimental group's pre and post administration results on grade 3 students' achievement in Arabic language.

In order to answer this hypothesis and taking into consideration that the scores are normally distributed, the paired sample T-test was used after verifying that there are no major outliers in our results.

The paired sample T-test showed that there is a mean significant difference between the scores pre and post: $t(2293) = -23.221$; $p < 0.001$, the Arabic scores/grades increased significantly after the intervention.

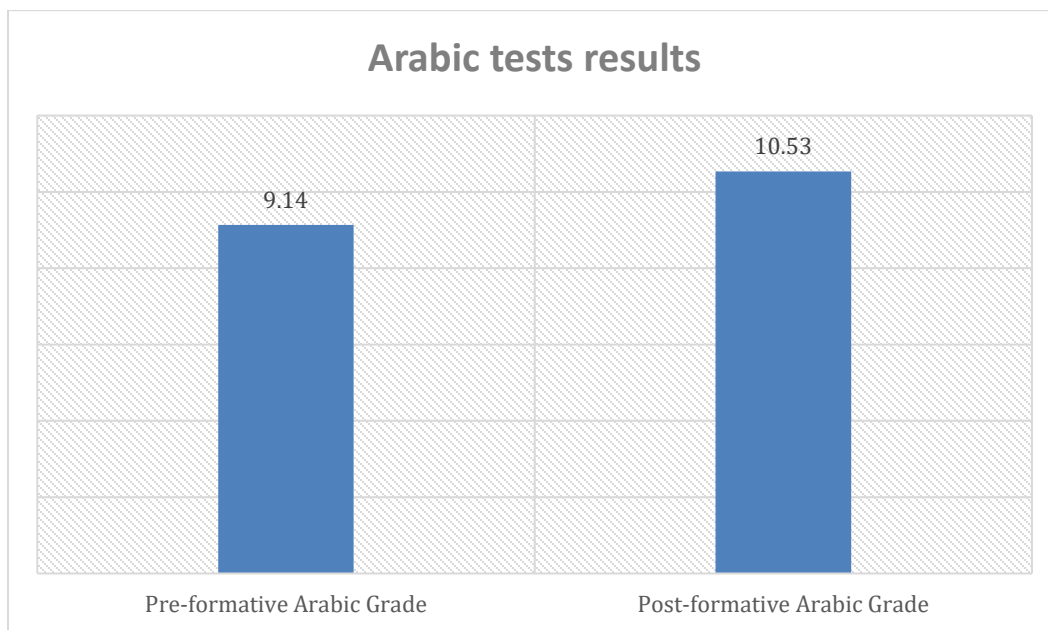


Figure 1: Arabic test results

Null Hypothesis: There will be no statistically significant difference between the experimental group's pre and post administration results on grade 3 students' achievement in mathematics.

Alternative Hypothesis: There will be a statistically significant difference between the experimental group's pre and post administration results on grade 3 students' achievement in mathematics.

In order to answer this hypothesis and taking into consideration that our scores are normally distributed, we used the paired sample T-test after verifying that there are no major outliers in our results.

The paired sample T-test showed that there's a mean significant difference between the scores pre and post: $t(2291) = -7.343$; $p < 0.001$ and the mathematics scores/grades increased significantly after the intervention.

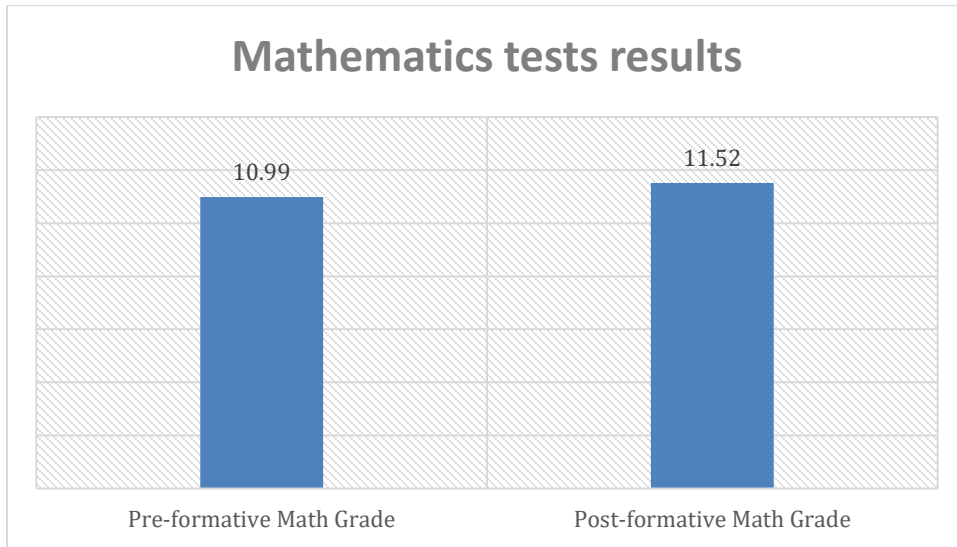


Figure 2: Mathematics test results

The comparison results for each item for the two subjects (Mathematics and Arabic) are represented in the Appendix #1.

Interpretation of the results

The mathematics and Arabic language achievement findings revealed significantly different scores before and after the intervention, which indicated how much students gained as far as learning was concerned. In the study, the academic achievements of the students where the formative assessment practices were applied were significantly higher than the scores before the intervention. This result conforms with the results of studies in mathematics (Anderson2017; Chemeli, 2019) and language (AlAhmadi,2019) and in particular Arabic language (Satar &Yusoff, 2019). The significant gain in students' learning may be associated with the intervention which followed the professional development of teachers.

The findings showed that intervention could improve teaching and learning, There was evidence of patterns of change as the teachers started to use some new strategies in teaching mathematics and Arabic,

Conclusion

Many teachers assess students at the end of an instructional unit. This study has shown, though implemented over a short period of time, that ongoing assessment that is fully integrated with instruction does not only help students chart and contribute to their growth but is as well part of teaching for success.

Using informal assessment strategies that are linked to instruction and that focus on students learning helps teachers make instructional adjustments to improve students' understanding and achievement goals and to determine students' understanding and learning needs to master a goal. This as well gives educators early alerts about students' misconceptions while allowing learners to build on previous experiences.

Making effective use of assessment for learning permits teachers to reflect on the effectiveness of their current teaching practices, work individually with students, present information differently to help students who struggle, plan challenging learning opportunities when students master outcomes, and identify students' misunderstandings for future learning opportunities. At the same time, this will give students the opportunity to determine what they

need to do achieve the intended learning outcomes, adapt or change their learning, evaluate their learning strategies and adopt new ways of learning when they are not achieving learning objectives, and reflect on current learning goals or set new goals.

Appendix

Appendix #1:

Table 6: Paired samples T-test general results

Pair comparison	t	df	p-value	Significant mean difference
phase1_.Q1_arabic phase2_.Q1_arabic	-3.973	2993	0.000	yes
phase1_.Q2_arabic phase2_.Q2_arabic	-9.891	2993	0.000	yes
phase1_.Q3_arabic phase2_.Q3_arabic	6.979	2993	0.000	yes
phase1_.Q4_arabic phase2_.Q4_arabic	-24.482	2993	0.000	yes
phase1_Total_arabic - phase2_Total_arabic	-23.221	2993	0.000	yes
phase1_.Q1_math phase2_.Q1_math	-11.727	2991	0.000	yes
phase1_.Q2_math phase2_.Q2_math	-7.705	2991	0.000	yes

phase1_.Q3_math phase2_.Q3_math	-10.547	2991	0.000	yes
phase1_.Q4_math phase2_.Q4_math	10.141	2991	0.000	yes
phase1_.Q5_math phase2_.Q5_math	4.191	2991	0.000	yes
phase1_.Q6_math phase2_.Q6_math	-6.438	2991	0.000	yes
phase1_.Q7_math phase2_.Q7_math	-2.869	2991	0.004	yes
phase1_.Q8_math phase2_.Q8_math	-17.566	2991	0.000	yes
phase1_.Q9a_math phase2_.Q9a_math	5.723	2991	0.000	yes
phase1_.Q9b_math phase2_.Q9b_math	0.566	2991	0.572	no
phase1_Total_math phase2_Total_math	-7.343	2991	0.000	yes

Glossary of Terms

Assessment of Learning: Assessment of learning is used to gather information about how well each student has completed the learning tasks and activities. It also provides information about students' achievements. The information it provides may be useful to the school, students and their parents while they have little impact in improving the teaching practices.

Diagnostic Assessment: Diagnostic assessment refers to assignments written at the beginning and end of a course. Post-course assessments can be compared with pre-course assessments and can show students' potential improvement in certain areas. These assessments allow the instructor to adjust the curriculum to meet the needs of current—and future—students.

Summative Assessment: Summative assessment is used to evaluate students' learning, skill acquisition, and academic achievement at the conclusion of a defined instructional period—typically at the end of a project, unit, course, semester, program, or school year. Generally speaking, summative assessments are defined by three major criteria: it is used to determine whether students learned what they are expected to learn. It is implemented at the end of a unit or course or school year and most of all it is recorded as a grade in the student's records with the aim of helping the school to take decisions.

Formative Assessment: Formative assessment as Paul Black states it: “When the cook tastes the soup, that's formative assessment. When the customer tastes the soup, that's summative assessment.” The distinction between formative and summative is often ambiguous in practice. In several practices, formative assessment is used as a synonym for summative assessment.

Norm-referenced Assessment: Norm-referenced assessment refers to standardized tests that are designed to compare and rank test takers in relation to one another.

Criterion-referenced Assessment: Criterion-referenced assessment are tests that measure performance against a fixed set of standards or criteria.

Interim Assessment: Interim assessment is used to evaluate where students are in their learning progress and determine whether they are on track to performing well on future assessments. Some examples include standardized tests, end-of-course exams, and other forms of “summative” assessment. Interim assessments are usually administered periodically during a course or school year (for example, every six or eight weeks) and separately from the process of instructing students.

Assessment for Learning: Assessment for learning (AFL) is an approach to teaching and learning that adopts feedback to improve a student’s performance. It highlights the idea that is illustrated in fig.3 identifying the three poles: Where the student is now? Where the student is going? How can the student get there?

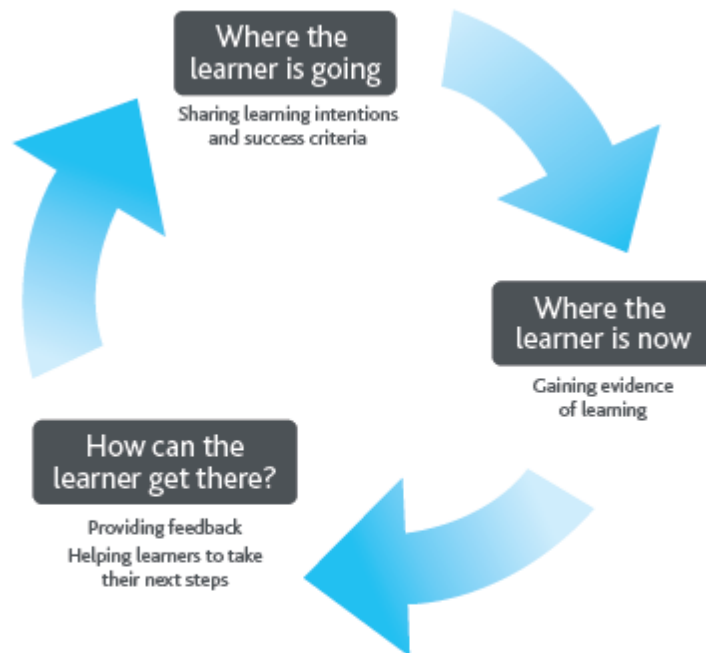


Figure 3: Types of assessment

Formal formative assessment: Formal formative assessment have data which support the conclusions made from the test. We usually refer to these types of tests as standardized measures. These tests have been tried before on students and have statistics which support the conclusion such as the student is reading below average for his age. The data is mathematically computed and summarized. Scores such as percentiles, stanines, or standard scores are mostly commonly provided by this type of assessment.

Informal formative assessment: Informal formative assessment are not data driven but rather content and performance driven. Informal formative assessment makes use of spontaneous assessments done to check on how students behave and perform in class as a source of feedback to improve teaching and learning.

Growth mindset: A growth mindset is when students understand that their abilities can be developed.

Zone of proximal Development. Zone of proximal development is the difference between what a student can do without help and what he or she can achieve with guidance and encouragement from a skilled partner. Thus, the term “proximal” refers to those skills that the student is “close” to mastering.

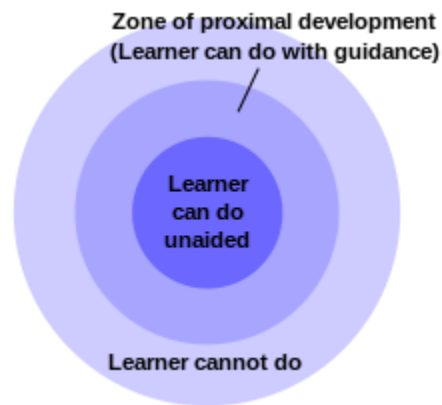


Figure 4: Zone of proximal development

Bibliography

- Alahmadi, N., Alrahaili, M., & Alshraideh, D. (2019). The Impact of the Formative Assessment in Speaking Test on Saudi Students' Performance. *Arab World English Journal*, 10 (1) 259-270. DOI: <https://dx.doi.org/10.24093/awej/vol10no1.22>
- Andersson, Catarina & Palm, Torulf. (2017). The impact of formative assessment on student achievement: A study of the effects of changes to classroom practice after a comprehensive professional development programme. *Learning and Instruction*. 49. 92-102.
- Appleton, J., Kim, D., Christenson, S., & Reschly, A. (2006, October). Measuring Cognitive and Psychological Engagement: Validation of the Student Engagement Instrument. *Journal of School Psychology*, 44(5), 427-445.
- Bae, S., & Kokka, K. (2016). *Student Engagement in Assessments: What Students and Teachers Find Engaging*. Stanford: Education and Stanford Center for Assessment, Learning and Equity.
- Bales, K. (2020, February 11). Creative Examples of Informal Assessments for the Classroom. Retrieved July 23, 2020, from <https://www.thoughtco.com/informal-classroom-assessments-4160915>
- Bennet, R. (2011). Formative Assessment: A critical Review. *Assessment in Education: Principles, Policy and Practice*, 18(1), 5-25. doi: 10.1080/0969594X.2010.513678
- Berry, R. (2011). Assessment Reforms around the World. In B. A. Rita Berry, *Assessment Reforms in Education* (pp. 89-102). doi:10.1007/978-94-007-0729-0_7
- Black, P., & Wiliam, D. (2006). Assessment and Classroom Learning. *Principles, Policy and Practice*, 5, 7-74. doi:10.1080/0969595980050102
- Burns, M. (2005). *Assessment in Mathematics*. Retrieved from [learnalberta.ca: http://www.learnalberta.ca/content/mewa/html/assessment/types.html](http://www.learnalberta.ca/content/mewa/html/assessment/types.html)
- Cauley, K., & Mcmillan, J. (2010). Formative Assessment Techniques to Support Student Motivation. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, 83(1), 1-6.
- Chemeli, J. (2019). Impact of the Five Key Formative Assessment Strategies on Learner's Achievement in Mathematics Instruction in Secondary Schools: A Case of Nandi County, Kenya. *Int. Acad. J. Soc. Sci. Edu.* 2 (1), 212-229.
- Cizek, G. (2010). An Introduction to Formative Assessment: History, Charectisritics and Challenges. In H. Andrade, G. Cizek, & R. Bennet, *Handbook of Formative assessment* (pp. 3-20). New York: Routledge.
- Clark, I. (2010). The Development of 'Project 1': Formative Assessment Strategies in UK Schools. *Current Issues in Education*, 13(3), 1-34.
- CRDP. (2000). *Evaluation guide*. Beirut: Center for Educational Reasearch and Development.

- CRDP. (2015). *Early Grade Reading Assessment*. Beirut: Center for Educational Research and Development.
- Duckor, B., & Holmberg, C. (2017). *Mastering Formative Assessment Moves: 7 High-Leverage Practices to Advance Student Learning*. Melbourne: ASCD.
- Dweck, C., & Legget, E. (2000). A social-cognitive approach to motivation and personality. In H. & Kruglanski, *ey reading in social psychology. Motivational science: Social and personality perspectives* (pp. 394–415). Psychology Press.
- Earl, L. (2003). *Assessment as Learning: Using Classroom Assessment to Maximize Student Learning*. California: Corwin.
- Earl, L. (2006). *Rethinking Classroom Assessment with Purpose in Mind*. Manitoba: Government of Manitoba.
- ERO. (2018). *Evaluation at a Glance: A Decade of Assessment in New Zealand Primary Schhols-Practice and Trends*. New Zealand: Education Review Office. Retrieved from www.ero.govt.nz
- Fredricks, J., Blumenfeld, P., & Paris, A. (2004). School Engagement: Potential of the Concept, State of the Evidence. *Review of Educational Research*, 74(1), 59-109.
- Guskey, T. (2003). How classroom assessments improve learning. *Educational Leadership*, 60(3), 6-11.
- Keeley, P., Eberle, F., & Dorsey, C. (2007). *Uncovering Student Ideas in Science: 25 more assessment probes* (Vol. 2). Arlington: NSTA Press.
- Keely, P., & Tobey, C. R. (2013). *Mathematics Formative Assessment: 75 Practical Strategies for Linking Assessment, Instruction and Learning* (Vol. 1). Newton,MA: Corwin and NCTM.
- Milawati, M. (2017). Teacher Questioning as a Formative Assessment Strategy in EFL Context. *Journal of English Language Teaching and Linguistics*, 2(2), 2503-1848.
- OECD. (2009). *Creating Effective Teaching and Learning Environments: Results from Talis*. Paris: OECD.
- OECD. (2020). *Teaching in the United Arab Emirates: Ten Lessons from TALIS*.
- Pappas, C. (2015, July 7). Formative Assessment In eLearning: What eLearning Professionals Should Know. *eLearning Industry*. Retrieved from <https://elearningindustry.com/formative-assessment-in-elearning-what-elearning-professionals-should-know>
- Roos, B., & Hamilton, D. (2004). Formative and Summative Assessment: A cybernetic viewpoint. *Assessment in Education:principles, policy and practice*, 12(1), 7-20.
- Rowe, J. (2012, February 9). *Assessment as Learning*. Retrieved from ETEC 510: Design Wiki: http://etec.ctlt.ubc.ca/510wiki/index.php?title=Assessment_as_Learning&oldid=62351
- Satar, H. and Yusoff, N. (2019) Improvement of Lower Secondary Arabic Language Teaching and Learning through the Implementation of Classroom-Based Assessments (PBD). *Creative Education*, 10, 2555-2563. doi: [10.4236/ce.2019.1012183](https://doi.org/10.4236/ce.2019.1012183).

- Seker, H., & Komur, S. (2008). The Relationship between Critical Thinking Skills and In-Class Questioning Behaviours of English Language Teaching Students. *European Journal of Teacher Education*, 31(4), 389-402.
- Shaaban, K. (2000). Assessment of Young Students' in ESL Classes in Lebanon. *Language, Culture and Curriculum*, 13(3), 306-317. doi:10.1080/07908310008666606
- Sondergeld, T., Bell, C., & Leusner, D. (2010). Understanding How Teachers Engage in Formative Assessment. *Teaching and Learning*, 24(2), 72-86.
- Vaughan, N. (2014). Student Engagement and Blended Learning. *Education Sciences*, 4, 247-264.
- Viering, M. (2016, August 1). An argument for formative assessment: Motivation and persistence. IOWA, USA.
- William, D. (2010). An Integrative Summary of the Research :iterature and Implications for a New Theory of Formative assessment. In H. Andrade, G. Cizek, & R. Bennet, *A Handbook of Formative Assessment* (pp. 20-40). New York: Routledge.
- Zohar, A., & Dori, J. Y. (2003). Higher order thinking skills and low-achieving students: Are they mutually exclusive? *The Journal of the Learning Sciences*, 12(2), 154-181

قائمة المراجع العربية

1.	بخيت، عبد العزيز. (2017). نتائج TIMSS2015 العالمية ونتائج ماجروهيل المحلية. صحيفة مكة المكرمة الرقمية.
2.	الأونسكو. (2013). إستراتيجية إعداد المعلم وتطويره المهني. العراق: مكتب العراق.
3.	البرصان، إسماعيل. (2015). الممارسات التكوينية والتقويمية والختمية لمعلمي الرياضيات في المرحلة المتوسطة في المملكة العربية السعودية. مجلة العلوم التربوية والنفسية، المجلد 16، العدد 2.
4.	تعلم الأقران. (2017). مجلة التربية، العدد الرابع، الرياض: مكتب التربية العربي لدول الخليج.
5.	الحري، عيسى ناصر. (2011). الممارسات التكوينية لمعلمي الرياضيات في ضوء مناهج سلسلة McGraw- Hill النسخة العربية، (رسالة ماجستير غير منشورة). الرياض: جامعة الملك سعود، قسم المناهج وطرق التدريس.
6.	حمادات، محمد حسن. (2009). المناهج التربوية. الأردن: دار الحامد.
7.	حمدان، محمد. (2007). معجم مصطلحات التربية والتعليم. عمان: دار كنوز المعرفة.
8.	حميدة، إمام. (2000). أسس بناء تنظيمات المناهج. القاهرة: مكتبة زهراء الشرق.
9.	الحيلة، محمد محمود. (1999). التصميم التعليمي نظرية وممارسة. عمان: دار المسيرة.

10	الخطابية، أكرم زكي. (1997). المناهج المعاصرة في التربية الرياضية. عمان: دار الفكر.
11	خليفة، عائشة محمد. (2018). معتقدات معلّّات الرياضيات في مدينة الرياض حول التّقييم التكويني. المجلة الدولية للدراسات التربوية والنفسية، العدد 4.
12	خويلة، أحمد. (1990). دراسة تحليلية لكتاب المطالعة والنصوص للصفّ الثاني الثانوي في الأردن، (رسالة ماجستير). الأردن: اربد، جامعة اليرموك.
13	الدريج، محمد، الحنصالي والموسوي، عمّار وحسن، حمّود. (2011). معجم مصطلحات المناهج وطرق التدريس. الرباط: المنظمة العربية للتربية والثقافة والعلوم (ألكسو).
14	زاير، سعد عليّ، هاشم والمندلاوي. (2016). التنمية المستدامة: تطبيقات تربوية. الأردن: دار الوضّاح.
15	السعيد، رضا، وعبد الحميد، ناصر السيّد. (2010). توكيد الجودة في مناهج التّعليم: المعايير والعمليّات والمخرجات المتوقّعة. الإسكندرية: دار الكتاب الجامعيّ.
16	السّمير، محمّد. (1994). مدى مراعاة كتب اللّغة العربيّة للصفوف الثلاثة الأولى للأسس النفسيّة للمناهج من وجهة نظر معلّّميها، (رسالة ماجستير). الأردن: جامعة اليرموك.
17	الشّايح، فهد بن سليمان، وعبد الحميد، عبد الناصر محمّد. (2011). مشروع تطوير مناهج الرياضيات والعلوم الطبيعيّة في المملكة العربيّة السّعوديّة: آمال وتحديات. المؤتمر العلميّ الخامس عشر. المملكة العربيّة السّعوديّة.
18	شحاتة، حسن، والنّجار، زينب. (2003). معجم المصطلحات التربويّة والنفسية. القاهرة: الدار المصريّة اللبنانيّة.
19	الشّمراني، سعيد. (2017). الممارسات التّقويمية لمعلّمي العلوم في محافظتي الزّلفي بالمملكة العربيّة السّعوديّة وفق تصوّراتهم. المجلة الدوليّة للبحوث التربويّة، العدد 2، المجلّد 41.
20	الصّوفي، عبد الله إسماعيل. (2000). معجم التّقنيّات التربويّة (الطّبعة الثانية). عمان: دار المسيرة.
21	صيّداوي، أحمد، ونخلة، وهبة. (1988). التّقييم التّكوينيّ الشّامل. المؤتمر التربويّ السنويّ الرّابع 5-7 ابريل. البحرين.
22	عاشور، راتب. (1990). القيم الاجتماعيّة في كتب القراءة لطلبة الصفوف الأربعة الأولى في الأردن، (رسالة ماجستير). الأردن: اربد، جامعة اليرموك.
23	عبّود، عطية. (2007). أثر استخدام التّقييم التّكوينيّ في تدريس مادّة الخطّ العربيّ في تحصيل طلبة المرحلة الثانية، مجلة كلتية التربية الأساسيّة، العدد 50. العراق.

24	عرفه، محمود صلاح الدين. (2005). تعليم وتعلم مهارات التدريس في عصر المعلومات. القاهرة: عالم الكتب.
25	فلية، فاروق عبده، والزّاكي، أحمد عبد الفتّاح. (2004). معجم مصطلحات التّربية لفظًا واصطلاحًا. الإسكندرية: دار الوفاء.
26	كاظم، علي مهدي. (2007). اتجاهات المعلمين والطلّبة وأولياء الأمور نحو التّقويم التّكويني، وعلاقته بدوره للالتحاق بالتّعليم العالي وعالم العمل. مجلّة كئيّة التّربية، العدد 24. جامعة الإمارات العربيّة المتّحدة.
27	اللّقاني، أحمد حسين، والجمال، عليّ أحمد. (1999). معجم المصطلحات التّربويّة. القاهرة: عالم الكتب.
28	المجلس الأعلى للتّعليم. (2016). معايير المناهج التّعليمية لدولة قطر: اللّغة العربيّة (من صفّ الرّوضة حتّى الثّاني عشر). قطر.
29	محمّد، محمّد حسين. (2016). معايير التّقويم اللّغوي ومدى تطبيقها في الحلقة الثّانية من التّعليم الأساسيّ في دولة الإمارات العربيّة المتّحدة، (رسالة ماجستير). الإمارات العربيّة المتّحدة: جامعة الإمارات العربيّة المتّحدة UAEU.
30	محمود، إبراهيم وجيه. (2004). التّعلم: أسسه ونظريّاته وتطبيقاته. الإسكندرية: دار المعرفة الجامعيّة.
31	المنوفي، سعيد جابر. (2011). التّقييم الصّفيّ: رؤية معاصرة للتّقييم التّربويّ. القاهرة: مكتبة الأنجلو المصريّة.
32	مؤسّسة الكويت للتّقدّم العلميّ. (2004). الموسوعة العلميّة للتّربية. الكويت.
33	هني، خير الدين. (1999). تقنيّات التّدريس. الجزائر: وزارة التّربية الوطنيّة.
34	الهيئة القوميّة لضمان جودة التّعليم والاعتماد. (2009). وثيقة المستويات المعياريّة لمحتوى مادّة اللّغة العربيّة للتّعليم قبل الجامعيّ. القاهرة.
35	وزارة التّربية الوطنيّة. (2009). إصلاح المنظومة التّربويّة، ج1. الجزائر: المديرية الفرعيّة للتّوثيق، مكتب النّشر.
36	وزارة التّربية والتّعليم. (2011). الوثيقة الوطنيّة المطوّرة لمنهج مادّة اللّغة العربيّة للمراحل من رياض الأطفال حتّى الثّاني عشر الثّانويّ. دبي.

37.	وزارة التربية والتعليم. (2013). الرياضيات للصف الأول المتوسط: الفصل الدراسي الأول: (دليل المعلم). المملكة العربية السعودية: العبيكان للأبحاث والتطوير.
38.	وزارة التربية والتعليم. (2004). الامتحانات والاختبارات. الأردن: مديرية الاختبارات.
39.	وزارة التربية. (2019). العربية لغتي: الصف الثالث الأساسي. الجمهورية العربية السورية.
40.	ياسين بن محمد، شريفين. (2006). التحفيز التربوي. الجزائر: المدرسة العلمية الجديدة.