



The Knowledge Level of Formative Assessment among High School Science Teachers'

Nora Samah Lafi Al Rashidi, Prof. Nidal Shaaban Al-Ahmad

Abstract: *This study aimed to identify the level of knowledge of the formative Assessment among female science teachers at high school from the point of view of the teachers themselves. To achieve study object, the researcher followed the descriptive analytical approach, a questionnaire was used, which consisted of (20) paragraphs divided into two domains,: "knowledge of formative assessment, and knowledge of formative assessment methods", the study sample consisted of (91) of science teachers distributed in the disciplines of (chemistry physics, and biology). The results of the study showed that the level of knowledge of secondary school science teachers to formative assessment and formative assessment methods was in "medium level" with a total arithmetic mean (2.18) and in medium average level of knowledge according to the responses of the study sample members in the study a questionnaire items. The researcher produce a number of recommendations, which are: Training female teachers to employ formative assessment methods, and including practical applications of formative assessment within teacher preparation programs in the faculties of education in Saudi universities.*

Keywords: *knowledge, Formative assessment, science teachers.*

1. INTRODUCTION

Assessment is one of the most important elements of the educational process, as it is directly related to all its elements, and through it judges the extent of the success or failure of the educational process outcomes. to achieve the desired goals.

Therefore, assessment is one of the most important inputs to the required educational process; To ensure the quality of education, and improve student learning levels can only be achieved through a comprehensive reform process of assessment (Mustafa & Sanad, 2016), and in this the American Association for the Advancement of Science (AAAS) confirmed that any attempts to reform science curricula It should include reforming the students' assessment; for being a prime objective; Therefore, the world today is witnessing a movement of reform of assessment systems in conjunction with the development of science curricula (Hashem & Al-Khalifa, 2017).

Educational process, and is even viewed as a reliable basis for improving and developing the educational process, because assessment results provide useful information and feedback in this field. Students enrich their learning, as the learning process is inseparable from the assessment process, but rather two interactive and complementary processes (Al-Dawlat, 2016). The recent trends of assessment came as a result of a change in the concept of learning, which moved from a behavioral perspective to a cognitive constructivist perspective, which sees that the meaning of learning occurs when the learner has a knowledge base that can be used flexibly to solve problems and make decisions that give a sense of this world (Diab, 2003). The learner needs the ability to self-identify, a sense of competence, and continue to strive to acquire and use learning assessment tools, and he also needs to be active in his learning (Al-Saadawi, 2018).

The concept of assessment has been associated with the majority of educators with tests, as it is clear that tests are the most common method among the assessment methods, because they emphasize measuring information preservation despite sometimes neglecting other aspects related to higher levels of cognitive organization, as well as the skill and emotional aspects, although There are other assessment methods, including, for example: oral class questions, performance tests, checklists, assessment and observation sheets, interview, self-assessment tools, and open assignments that are answered outside the classroom or at home (Sabri & Al-Rafei, 2012).

Referring to the educational literature in the field of measurement and assessment, we find multiple names for assessment, including: alternative assessment or authentic assessment such as structural

assessment, formative assessment, continuous assessment, real assessment, performance-based assessment, and other names, and whatever the names are different, they all refer to the shift from Traditional assessment based on tests to assessment that reflects the learner's achievements in real learning situations (Kreusel, 2011).

Two concepts have emerged in the field of assessment, namely: assessment of learning, which is known as summative assessment; Assessment for learning, which is called formative assessment, or formative assessment (Al-Hakami, 2007; Majeed, 2011). and the two assessments: final and formative, have in common that both types use almost the same methods (Al-Dosari, 2014), which Most notably: continuous daily tests: oral and written, reports, discussion, observation of student performance, homework and follow-up, exercises and practical applications (Khalil, 2011; Maroun, 2010; Sayed, 2003),

While the difference lies in the use of assessment results for each of them in Making different decisions (Al-Dosari, 2014). In the final assessment, the results of the assessment are used to ensure that students have achieved the desired goals. In the formative assessment, they are not only used to verify the occurrence of learning, but to raise the level of learning (Stiggins and Chapois, 2013), through Monitoring students' progress throughout the semester, as it interferes with the students' learning process; With the aim of correcting its course, and addressing the difficulties it encounters, relying on the feedback that the teacher and the learner benefit from, so the learner benefits from it in modifying his path; To achieve the desired goal, or to enhance its success, while the teacher benefits from it in modifying and improving teaching methods; To reach the learner to the desired goals (Al-Tawam, 2016; Al-Huwaidi, 2015; Khalil, 2011; Othman, 2011; Attia, 2008).

The shift of focus from the final assessment to focusing on formative assessment is evidence and acknowledgment that formative assessment is equally important with the final assessment (Prashanti & Ramnarayan, 2019). Studies indicate that the main benefit of the formative assessment process stems from the fact that its continuous application contributes to improving student achievement, from By providing teachers with evidence that indicates their current level of understanding, and accordingly teachers are able to help their students achieve the desired educational goals (Mustafa & Sanad, 2016; Duckor, 2014), and many studies have confirmed the existence of a positive impact of the practice of formative assessment in developing academic achievement: as studying each By (Al-ajami, 2012), Al-Matroudi, 2014), Sobeih, 2014).

Formative assessment depends on the diversity of assessment methods, such as oral, audio, written and practical assessment, using several techniques such as observation, tests, self-assessment, peer assessment, educational packages, business files, and others (Keleghan, 2011). Therefore, the formative assessment has brought about radical transformations in the strategies of educational assessment in general and evaluating students' achievement and performance, especially the shift from the policy of tests to the policy of formative assessment and multi-assessment, and the shift from testing of cognitive abilities to assessment of multiple abilities, and the shift from a separate assessment to an integrated and continuous assessment (Al-Dosari), 2014).

There have been many definitions of formative assessment, as Black & William (2009) defined it as all activities undertaken by teachers or their students that provide ready-to-use information: as feedback; (Popham (2008/2012, p. 26) defines it as a planned process from which data on student assessment is extracted that teachers use to modify their current methods of teaching, and students use it to modify their current learning systems. It is defined as a planned and continuous process used by all students and teachers during learning and teaching; to elicit and use evidence; To improve students' understanding of target instructional outcomes, and support students; To become self-taught learners, State Collaborative on assessment and Student, (McMillan, 2007) defined it as a set of activities carried out by teachers; To provide feedback that is in the interest of the students; To enhance their motivation and education level.

The formative assessment process is based on the social constructivist theory, which states that students' knowledge actively develops over time while they are in an interactive social learning environment, directed by the teacher (Al-Busaidi, 2015; Zaitoon, 2015). Formative assessment helps assess students' prior knowledge and is thus the meaning is based on the learners' previous knowledge and builds on it, so that the teacher can know the strengths and weaknesses in the students' knowledge, and then that knowledge develops and new knowledge is added to it by the students

themselves. During this learning process, students and teachers interact with each other. Through the formative assessment process, teachers get the information they need about students' progress and interaction, as teachers monitor learning through dialogue with students, while students learn from each other, and from the feedback that the teacher obtains through students' response to different learning activities. Therefore, formative assessment is more than just activities, but rather consists of a series of steps that contribute to the formation of a positive and continuous relationship between teachers and their students (Duckor, 2014).

Perhaps this study is justified by the presence of several indicators indicating the low level of science teachers' knowledge of formative assessment and its methods of teaching in science courses, and the focus on knowledge of tests as the only means of measuring students' learning level, in addition to the fact that this study is in line with the principles of educational development in the Kingdom. Saudi Arabia, which is based on the need to review assessment systems and the multiplicity of its tools and methods. This is what prompted the researcher to conduct this study to find out the current reality of science teachers' knowledge of formative assessment and its methods in teaching science to the secondary stage in schools in Al-Kharj region, perhaps shedding light on its strengths and weaknesses in order to modify and improve it, and try to identify the formative assessment and its methods, and strategies in teaching science. Several studies have been conducted that dealt with student learning assessment and its various tools, and examples of these studies are: Khalifa study (2018), which showed that mathematics teachers agreed that the purpose of formative assessment is to inform students of their level of achievement, and with regard to the most used practices, the study showed that observation Classroom is the most used practice, while peer assessment was the least practiced during the teaching process. The study recommended the necessity of educating female teachers about the role that formative assessment plays in improving performance and student achievement. As for the study of Al-Zahrani (2017) it included (202) female and male mathematics teachers in primary schools in the Al-Baha region, and its results showed that teachers have a high level of knowledge of formative assessment, but the level of their practice of formative assessment is low. While the study of Al-Bursan et al. (2015) showed a discrepancy in the practices of formative assessment among teachers, as the study confirmed that the most frequently used assessment practices are the questions in the textbook, and the least common is the student's participation in self-correction of homework or collectively, which causes the student to lose the assessment skill. The study recommended the necessity of training teachers on the methods of formative assessment. Al-Mazrou' study (2014) also aimed to reveal the reality of formative assessment in science teaching at the intermediate stage in schools in the city of Riyadh. The results indicated that the general average of the belief domain about formative assessment practices was (2.53) out of (4), and it is at the level of approval. As for Suleiman's study (2007), which revealed the low knowledge of science teachers and his female teachers about formative assessment, and their shortcomings in their practice of formative assessment, which ranged between average and weak.

In light of the foregoing review of previous studies, it is clear the scarcity of studies targeting science teachers, with the exception of the study of Suleiman (2007), which targeted the middle school and applied in Jordan, and the study of Al-Khalidi (2016); And Al-Mazrou' (2014), where they were applied in Saudi Arabia, and it is similar to the current study in identifying the extent to which science teachers in the intermediate stage apply formative assessment methods, and quantitative methods have been used to collect data, and there is currently not enough data on the reality of formative assessment among secondary school science teachers, whether from Where their knowledge of it and its methods or in terms of the nature of the practices followed by them, which is what the current study is trying to investigate and find out.

2. STUDY PROBLEM

Many assessment experts at the present time focus on the role that the formative assessment process can play in monitoring student learning, following up on the learner, and its purposeful role in developing his intellectual abilities, and providing him with the necessary knowledge that helps him to pursue his academic specialization, or that qualifies him to enter practical life (Maron, 2010). The results of the studies showed the role of formative assessment in developing achievement, motivation towards learning, increasing self-efficacy, and scientific thinking (Al-Qahtani, 2018; Mintert, 2019; Watkins, 2018). The results of the spring study (2018) showed the impact of formative assessment in developing students' twenty-first century skills.

Black and William (Black & William, 2009) stressed in their article inside the black box the importance of the role that teachers play when applying formative assessment well, and its positive impact on learning if it is applied correctly, as formative assessment, when implemented effectively, can transform the culture of Separation into a culture that acclaims learning success, in addition to the best teaching practices that have an impact on improving student achievement is the formative assessment process (Duckor, 2014). Based on the foregoing, and since the researcher specializes in science, and has experience and knowledge of educational assessment strategies, she noticed that there is a difference in the level of knowledge and understanding of science teachers about formative assessment and its methods, as most of them still focus on the traditional assessment that is based on oral tests or writing. Therefore, the researcher decided to carry out this study, to determine the level of knowledge and practice of science teachers in the secondary stage of formative assessment and its methods in teaching science. Thus, the problem of this study can be determined by the following question: What is the level of knowledge of science teachers in the secondary stage of formative assessment and its methods in teaching science?

3. PURPOSE OF THE STUDY

This study Aimed to: Determine the level of knowledge of science teachers at the secondary stage of formative assessment and its methods in teaching science.

Theoretical Importance: It is hoped that this study will provide science teachers with a definition of the concept of formative assessment, its methods and sound practices in order to serve the objectives of the educational process in teaching science courses. It may also open the way for researchers in science curricula and methods of teaching the way to conduct more research on ways to employ formative assessment in an effective manner in teaching science and test its effectiveness in developing other variables in the curricula.

Applied Importance: The results of this study may benefit those in charge of teacher qualification and preparation programs, and educational training departments, which provides them with information about the extent of their knowledge of formative assessment methods, which helps determine the teachers' need for training programs. It may be useful to the curriculum developers in designing formative assessment tools and including its approved methods and methods in the teachers' guides accompanying the curriculum to help teachers employ them in more effective ways. The Study limits

Objective Limits: the level of knowledge of secondary school science teachers in Al-Kharj governorate for formative assessment and its methods in teaching science, in terms of knowledge: formative tests, observation, direct class questions, assignments and performance tasks, discussion, and practical applications; Because it is the most common methods in previous studies, and it was mentioned in the Secondary Education Guide for the year (1440 AH).

Time Limits: the first semester of the year 1442 AH.

Spatial Boundaries: Secondary schools for girls in Al-Kharj Governorate.

Human Limits: science teachers in Al-Kharj Governorate.

Procedural definitions:

Level of knowledge: Knowledge is defined as: "All mental processes of the individual: awareness, learning, thinking and judgment issued by the individual while interacting with his private world" (Al-Salem, 2002, p. 184). The researcher defines it procedurally: it is the degree of response of secondary school science teachers in Al-Kharj Governorate to the prepared questionnaire items, which reflects their level of knowledge of formative assessment methods.

Formative Assessment: It is the process that teachers and students use during learning. In order to provide the necessary feedback for the continuous adjustment and adjustment of teaching and learning; In order for students to achieve the desired educational outcomes (Furtak & Ruiz-Primo, 2008).

Formative Assessment Methods: Hashem and Al-Khalifa (2017, p. 69) defined assessment methods as "the methods and procedures that the evaluator uses to implement the assessment process." The researcher defines them procedurally: as the various methods of the planned formative assessment,

which were prepared in advance by the science teacher; It includes formative tests, observation, direct class questions, assignments and performance tasks, discussion, and practical applications. It aims to obtain information about the students' progress in their learning and provide feedback; to improve the learning process.

4. STUDY METHODOLOGY

To achieve the objectives of the study, the researcher followed the descriptive analytical approach to its suitability to achieve the goal of the study.

Study Population and Sample:

The study population and sample consisted of all secondary school natural science teachers in government schools affiliated with the Department of Education in Al-Kharj Governorate, who numbered (91) according to the statistics of the Education Department of Al-Kharj Governorate for the year 2020 for the first semester. They were divided into the majors of biology, chemistry and physics. Biology teachers are (30), the number of chemistry teachers is (33), and the number of physics teachers is (28).

Study Tool:

To achieve the study objective of determining the level of knowledge of science teachers of formative assessment and its methods in teaching science, the researcher used the questionnaire as a tool for the study, where she prepared a questionnaire consisting of (20) phrases to identify the level of knowledge of science teachers in the secondary stage of formative assessment methods, which were divided into two domains: Formative assessment formative assessment methods.

Content Validity:

The researcher verified the apparent sincerity of the tool by presenting it in its initial form to a group of arbitrators, which consisted of (12) arbitrators from faculty members specialized in curricula and teaching methods, and science teachers, to express their opinion about the tool in terms of: clarity of the questionnaire instructions, clarity of wording The phrases and the soundness of the wording, and the suitability of each phrase to measure the dimension of the formative assessment to which it belongs, and to suggest what the arbitrators deem appropriate in terms of deletion, modification or addition. To measure knowledge, domains were added to the questionnaire, until the tool reached its final form consisting of (20) phrases distributed on two domains (formal assessment, formative assessment).

Internal Consistency Validity:

To verify the internal consistency of the tool, the researcher applied the questionnaire in its final form initially to a pilot sample, which consisted of (30) parameters of the natural sciences with its various branches from within the research community, and through the sample data, the researcher calculated the Pearson Correlation Coefficient between the degree of each phrase The results showed that the values of the correlation coefficient of each of the statements with its domain are positive and statistically significant at the significance level ($\alpha \leq 0.01$), which indicates that all the questionnaire statements have a high degree of internal consistency, which confirms the strength of The internal correlation between all the statements of the tool, and therefore this result shows the consistency of the questionnaire statements in an integrated manner, and their validity for field application (Odeh, 2014).

Resolution Stability:

To ensure the stability of the tool, the Alpha Cronbach Coefficient was calculated after applying the tool to the pilot sample, and the results showed that the value of the Alpha Cronbach coefficient for the tool as a whole was (0.96), while its value for the first domain was (0.96), Its value for the second domain was (0.93), and these transactions are educationally appropriate and acceptable.

Statistical Methods:

To achieve the aim of the study, the following statistical methods were used:

- Arithmetic averages and standard deviations; To know the level of knowledge of science teachers at the secondary stage of the methods of formative assessment.

- Cronbach's alpha coefficient; To ensure the stability of the questionnaire, and the Pearson correlation coefficient of internal validity.

Study Results:

The results of the study question, which states: What is the level of knowledge of science teachers in the secondary stage of formative assessment and its methods in teaching science? To answer this question, the researcher applied a questionnaire to measure the level of knowledge of science female teachers at the secondary level for formative assessment and its methods in teaching science. The parameters responded to it on a three-way scale of response to the sample, which is (high, medium, and low), and these levels were given marks 3, 2, 1 Accordingly, after the questionnaires were collected and unloaded, the arithmetic averages and standard deviations were calculated, and the order of the response of the sample members to the expressions of knowledge of science parameters in the secondary stage of the formative assessment and its methods, and Table (1) shows the averages and standard deviations of the responses of the parameters of the research sample on the two domains of the questionnaire.

Table1. The averages and standard deviations of the responses of the parameters of the research sample on the two domains of the questionnaire

Domain	SMA	standard deviation	The level
Knowledge of formative Assessment methods.	2,25	0,484	Medium
Knowledge of formative Assessment.	2,04	0,592	Medium
level of the study instrument	2.18	0.538	Medium

Table (1) Showed that the arithmetic averages of the responses of the study sample members to the two domains of the study tool ranged between (2.04 -2.25), where the domain (Knowledge of Formative Assessment Methods) ranked first with an arithmetic average (2.25) and a medium degree of appreciation, followed by the domain (Knowledge of formative assessment) with an arithmetic mean (2.04) and a medium degree of estimation, and the total arithmetic mean of the tool was (2.18) and a medium degree of estimation. In order to find out the level of responses of the study sample members on the two domains, the averages and standard deviations of the responses of the study parameters on each domains were calculated, and tables (2, 3) illustrate this.

Table2. shows the averages and standard deviations of the responses of the parameters of the study sample on the domain of the questionnaire related to knowledge of the formative assessment.

Item	SMA	standard deviation	Arrange	level
I have good knowledge of the concept of formative assessment.	1,97	0,653	8	Medium
I have knowledge of using formative assessment; To determine the level of students' achievement of educational goals.	2,04	0,642	4	Medium
I know how to use a formative assessment; To identify gaps in students' understanding.	1,93	0,660	9	Medium
aspects of the formative assessment process; To provide feedback to the students about their performance.	2,12	0,730	2	Medium
I help the students through the formative assessment.	2,03	0,692	5	Medium
I use my knowledge of formative assessment in determining the strengths of students.	2,08	0,669	3	Medium
I have knowledge of ways to correct the learning process in the light of the results of the formative assessment	1,99	0,663	7	Medium

proses.				
I encourage mutual formative assessment among students through participatory learning activities.	2,03	0,711	6	Medium
I Allow the students to assess their learning on their own.	2,14	0,706	1	Medium
total	2,04	0,592		Medium

The results in Table (2) showed that the science teachers in the secondary stage see that their knowledge of formative assessment was at an average level, with an arithmetic mean of (2.04). The results of the study of Al-Bursan (2015), which indicated the weak knowledge of male and female teachers in Bahrain about formative assessment, and to some extent with the study of Suleiman (2007), which indicated that (38.3%) of teachers have sound knowledge of the concept of formative assessment, The phrase (I allow the female students to evaluate their own learning) ranked first compared to the rest of the phrases, and this result is consistent with what was indicated by the study of Al-Zahrani (Alzahrani, 2017) that teachers allow students to evaluate themselves and their peers to an average degree, and it differs with the study of Al-Mazrou (2014) about The teachers' belief that it is not necessary for the student to participate in self-assessment; Perhaps this difference was due to the transformation in the form of the learning process, the method of implementation, the benefit of e-learning, and self-learning due to the Corona pandemic (Coved 19).

The results also showed that the phrase (Aspects of the formative assessment process to provide feedback to students about their level of performance) came in second place with an average of (2.12), and perhaps this was due to the teachers' well-established beliefs about the importance of providing feedback to students, as indicated by the Al-Mazrou study. (2014), and this result is consistent with the findings of Al-Zahrani's study (Alzahrani, 2017), which indicated that all interviewing teachers provide regular feedback to their students about their learning progress, While in the third class came the phrase (I use my knowledge of formative assessment to determine the strengths of female students), while the least knowledgeable phrases of the female teachers were the phrase (I know how to use formative assessment; This is due to the lack of knowledge of the importance of identifying the gap and its methods, and this was indicated by the Al-Mazrou study (2014), which showed the weak knowledge of female teachers about the importance of identifying the gaps in the understanding of students. The phrase (I have good knowledge of the concept of formative assessment) got the penultimate order, and it differs in this from what was indicated by both the study of Al-Bursan and others (2015) and the study of Suleiman (2007), which indicated the weak knowledge of teachers with the concept of formative assessment. The researcher believes that this difference is not significant, as having knowledge of the concept of formative assessment to a moderate degree is considered unsatisfactory due to the importance of the role of formative assessment in the educational process.

Table3. shows the averages and standard deviations of the responses of the parameters of the study sample on the domain of the questionnaire related to the methods of formative assessment

Item	SMA	standard deviation	Arrange	the level
I know different methods of formative assessment	1,87	0,596	11	Medium
I have knowledge of the methods of employing formative evaluation methods	1,97	0,653	10	Medium
I offer the students support tasks; To help them overcome learning obstacles	2,14	0,626	8	Medium
I use the types of oral classroom questions according to the nature of the educational situation	2,29	0,649	6	Medium
I design correct performance standards and indicators before starting to teach	2,11	0,665	9	Medium
Students do the appropriate tasks	2,22	0,645	7	Medium
I use the observation method when reviewing the work of the students	2,42	0,617	2	High

I do homework; To determine the strengths and weaknesses of the students	2,42	0,659	3	High
I take advantage of periodic tests to know the progress of students' learning	2,47	0,621	1	High
I give the students written and oral notes	2,38	0,673	5	High
I use different methods to track performance	2,42	0,595	4	High
total	2,25	0,484		Medium

The results in Table (3) showed that the science teachers in the secondary stage had their knowledge of formative assessment methods at a level (medium), with an arithmetic mean of (2.25). At an average level, the phrase (I benefit from periodic tests in identifying the progress of students' learning) ranked first compared to the rest of the phrases, and this result agrees with the findings of Al-Zahrani's study (Alzahrani, 2017), and the researcher attributes this to science teachers' awareness of the importance of tests. The training course aims to reveal the level of students' progress towards the goals and give them indicators that help in improving the teaching process. The teachers confirmed that they (they employ the observation method when reviewing the work of the students) to a medium degree, and this result differs with what was shown by the results of the observation, as will be explained in the answer to the second study question, as none of the teachers used the observation method in the assessment, and this may be due to a lack of awareness note concept; As a method of formative assessment, and confusing it with the skill of scientific observation in practical experiments, and in the third order came the phrase (I use homework; to determine the strengths and weaknesses of female students), while the lowest levels of knowledge of the methods of formative assessment among teachers were represented in the phrase (I have knowledge of methods different for formative assessment) as it obtained the last rank with an average knowledge level. The paragraph (I have knowledge of the methods of employing appropriate formative assessment methods according to the educational goal) was ranked pen ultimately, with an average level of knowledge. Although the results of the current study indicate an average knowledge of formative assessment methods, they also indicate the need for more effort to develop the knowledge of the parameters in this field.

5. RECOMMENDATIONS AND SUGGESTIONS

In light of the study findings, the researcher recommends the following:

1. Holding training courses for science teachers to familiarize them with the nature of formative assessment and the methods of formative assessment in the educational process.
2. Providing science teachers with educational brochures on the methods and tools of formative assessment in science teaching.
3. Preparing samples of formative assessment tools and providing them to science teachers in order to benefit from them in the assessment processes used in science learning.
4. Studying the reality of science teachers' knowledge of formative assessment and its methods in academic stages other than the secondary stage, and in subjects other than science.
5. Conducting a study dealing with the obstacles to applying formative assessment in science education at the secondary level.

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Citation: Nora Samah Lafi Al Rashidi & Prof.Nidal Shaaban Al-Ahmad. " The Knowledge Level of Formative Assessment among High School Oe Science Teachers'" *International Journal of Humanities Social Sciences and Education (IJHSSE)*, vol 8, no. 12, 2021, pp. 83-92. doi: <https://doi.org/10.20431/2349-0381.0812009>.

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