

Research Article

Analysis Based on the Three Objective Educational Domains for Final Summative Secondary Examinations of Science Subject (Chemistry, Physics, and Biology)

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The aim of this study is to determine the representation of the areas of educational objectives (cognitive, psychomotor, and emotional) measured by the science, chemistry, physics, and biology (2018-2019) examination questions in the State of Kuwait (objective, categorical) and the availability of science operations. Content analysis was used as a method to analyze the final examinations in the lens of the three educational objectives domains. The results of the study showed that the number of questions of the science subjects (chemistry, physics, and biology) for the second semester of the academic year 2018-2019 was 136 questions as 46, 48, and 42 and that the average of all questions focused on questions related to lower cognitive levels. The study concluded with a set of recommendations to develop the process of final examinations for secondary schools and to rethink about the process of evaluating students with science concepts rather than limiting the subjects to sets of information from textbooks.

1. Introduction

Assessment is a process of gathering, interpreting, recording, and using information about students as a part of a teaching-learning process [1]. There are many types of assessments, while the most common assessment methods and tools that are common in education are diagnostic, formative, and summative [2]. Diagnostic assessment is usually used at the beginning of the school year. It helps to diagnose and identify students' abilities, weaknesses, and prior knowledge. Formative assessment mostly occurs in classrooms, between the teacher and his/her students. The interaction, observations, and feedback are all forms of formative assessment. Summative assessment takes place at the end of the teaching process. It takes different forms: written tests, end of unit tests, final examinations, or standardized tests at the end of the school year [2]. According to Garrison and Ehringhaus [3], the summative assessment may be associated with standardized tests, district benchmark, or end of term or semester. It also helps teachers and educators to reflect on

their teaching styles and student's understanding through the lens of students' performance [3].

Every country has its system in assessing its students, especially in high school, to determine the qualified ones to continue their higher degree. Until our recent time, these assessments in forms of written tests or examinations are still considered core elements in any education system which reflect both students' understanding and the quality of teaching [4]. There are many arguments regarding the fact that examinations are the dominant and fundamental method in the educational evaluation and how it is a limited method in measuring students' knowledge. Nevertheless, examinations are still used to measure the strengths and weaknesses of students' understanding, modify and develop curriculum, and judge the efficiency of the teaching methods [4].

Like many other countries, Kuwait's public education system has a well-established examination process that is considered highly centralized and is prepared, revised, and evaluated by the technical supervisors for each discipline [5].

The evaluation of student achievement in Kuwait, for the purpose of promotion from one grade to another, requires a minimum score of 50 percent in each of the core subjects: math, science, Arabic, English, social studies, Islamic studies, and Quran studies [5]. The major grades from the elementary level to secondary school are heavily reliant on tests. Each semester, students are tested three times, followed by final examinations.

Test frameworks are offered from the supervisory unit. Teachers, heads of departments, and supervisors all collaborate in writing unified summative tests that are being distributed to all public schools of the State of Kuwait. Each school district tests their students at the same time on the same subject. Only in the last year of secondary school, final examinations are unified throughout the whole country [6].

Since the twelfth level is considered the exit phase from schools, it is considered a critical matter in terms of preparations and grading. The focus of this research is to study the examination questions based on Bloom's cognitive levels and the educational goals in order to create a benchmark for future studies and development in the examinations system. Science has been chosen as a subject of exploration not only because it is a core subject but also because it is considered as an interdisciplinary subject being taught in its three different fields (chemistry, biology, and physics); teaching science is a national priority in Kuwait and it is part of the educational reform plans [7].

2. Literature Review

2.1. Secondary School Final Examination Contexts. The psychologist Resnick [8] states that "What we assess is what we value. We get what we assess, and if we do not assess it, we do not get it." High school level is extensively crucial in the education system of Kuwait, since it is considered the prerequisite for a college degree. In light of the university admissions system, the focus of the students is on how to obtain a high GPA that qualifies them to join certain disciplines. This has led to the typical teaching for the testing process and the training of students on repeated forms of examinations leading to meaningless learning, stumbling, and a high rate of inflation in the final grades [5].

On the other hand, the Ministry of Education (MOE) dedicates massive preparations for the examinations process, especially the final examinations for the twelfth grade every year. The department of examinations at the MOE is led by a committee of technical supervisors who are tasked to formulate, review, and produce highly precise questions for each core subject [7]. Yet, these examinations are produced by the same supervisors who created the curriculum and assessed the teachers which is one of the rationales to analyze the examinations and understand the summative assessment in Kuwait. The arguments claim that the education system in Kuwait lacks proper high-order thinking preparation for children, and that is due to focusing only on memorizing facts [9]. The dilemma that faces education and training lies in the learning process itself. Instead of teaching for learning and understanding, the current situation pushes toward becoming a test-advocate that evaluates students

temporarily based on memorizing disjointed information to pass the tests. Unfortunately, the aim of the learning outcomes is linked to passing tests with high scores for students, parents, and teachers [7].

The evaluation system in Kuwait does not really demonstrate whether an individual student's performance is acceptable, high, or low unless it is compared to a set of standards and norms. Final examinations and summative assessments usually are used as an evaluation tool for curriculum, teacher performance, and school performance; however, the MOE is limiting it to report the student's success [10].

2.2. Science as a Case. Science curriculum takes an enormous part of the examinations since students who majored in science are supposed to complete the three main domains: biology, chemistry, and physics. Also, nonscience majors are obliged to complete science courses prior to graduating from secondary school. Science majors in secondary school are being prepared to pursue the science field once they finish their secondary school. Science curriculum and structure in Kuwait pursue critical thinking, solving problems, analyzing data, and decision making [11]. Science subjects are being taught in fully equipped laboratories on daily basis in secondary schools. However, this attention in science is confronted with disinterest in the subject. Based on the Central Statistical Bureau (CSB), 65.69% of students enrolled in nonscience majors at Kuwait University while only 34.30% chose science majors in the school year 2017-2018. Another study discussed that secondary school students face challenges in learning science due to the methods and the assessment mechanism which decreases their motivation toward science [11, 12]. Al-Kandari, Ramdane, and Nordin have reasoned that some of the challenges are related to the misused and limitation of using the cognitive domain [9]. Nevertheless, a study focused on science secondary teachers stated that science teachers face difficulties with the curriculum objectives, student assessment system, school management, and lack of science laboratories' equipment which reflect negatively on the student outcomes [9, 11].

The launch of the medium-term economic development plan of the State of Kuwait was associated with reforming education for the whole country. Additionally, the General Secretariat of the Supreme Council for Planning and Development (2016) stated that Kuwait ranked 99th globally in the Quality Index of Mathematics and Science Education (out of 140 countries), even though the Kuwaiti government's expenditure on the educational sector is relatively high [13]. The job market still lacks fields in Science, Technology, Engineering, and Mathematics (STEM) while more inflation toward non-STEM fields. Another reason for focusing on science as a subject is that the overall performance in science is relatively low for Kuwaiti students based on Trends in International Mathematics and Science Study (TIMSS) international results. Unfortunately, Kuwait did not participate in the Program for International Student

Assessment (PISA) which makes it more essential to analyze the current examinations in order to understand the system and then provide better alternatives [14].

2.3. The Process of Building up the Science Final Examinations.

The present study aims to determine the percentage of educational objectives (cognitive, psychomotor, and emotional) that are measured in the high school (chemistry, physics, and biology) in Kuwait, the percentage of knowledge levels measured by these questions as well as the representation of the types of questions (objective, categorical), and the availability of science processes in the questions of the general secondary school in science subjects (chemistry, physics, and biology) in the State of Kuwait for the latest school year 2018-2019.

Benjamin Bloom created the taxonomy and it was later revised by Lauren Anderson who was a student of Benjamin Bloom. The revised version from 2001 serves as the backbone of many teaching philosophies, in particular, those that aim toward teaching specific skills. Each level usually comes with a clear learning objective that can be tested. Also, researchers took into consideration the other two educational domains while conducting the study.

Therefore, this study seeks to analyze the final examinations based on educational taxonomies to answer the following:

What are the types of secondary school (chemistry, physics, and biology) examination questions? More specifically:

- (i) What is the ratio of the three educational objectives areas (cognitive, psychomotor, and emotional) among the subjects (chemistry, physics, and biology) in the final examinations?
- (ii) What is the representation of the levels of knowledge in accordance with Bloom's taxonomy in each examination?
- (iii) What is the representation of the types of questions (objective, essay) in each examination?
- (iv) What is the representation of the questions of each examination for every field of science (chemistry, physics, and biology) in the State of Kuwait for the relative importance of science books units for the twelfth grade?

3. Contribution of This Paper to the Literature

The importance and objectives of the current study are as follows:

- (i) We will discuss the results of the study: The absence of in-depth analysis of Kuwaiti secondary school science examinations (chemistry, physics, and biology). The results can be discussed and shared with stakeholders at the MOE for further development
- (ii) The study provides information that can be used by officials in examination development committees such as specialized technical instructors, curriculum

management, and developing science examinations questions (chemistry, physics, and biology)

- (iii) It gives a true picture of the pattern of science subject examinations (chemistry, physics, and biology), which is useful in improving the quality of questions and raising their levels to fit with the vision of science curricula, its mission, and goals
- (iv) The study provides samples for the content analysis of the questions included in the examinations of the general secondary certificate in science subjects (chemistry, physics, and biology) in the State of Kuwait, which benefits the final examinations preparers

4. Conceptual Framework

4.1. Background. In developing curricula and educational goals, a gradual process of information and concepts will be taken into account according to the capacities that grow with the child's development. The first to develop these classifications and divide them into degrees and stages is the educational psychologist at the University of Chicago Benjamin Bloom in 1956, who developed classification science Taxonomy of Educational Objectives, known as "Bloom's taxonomy," which is a classification of levels of study goals that teachers set for their students. Through this classification, he divided the goals into three areas: cognitive, behavior, and psychomotor. He believed that learning is essentially an effort to make full use of the energies of learners. His principles of education were evident in his individual conversations with his students. He directed his attention to setting the specifications of educational goals and showed that cognitive goals can be organized and arranged on the basis of the complexity of the knowledge itself.

This classification depends on the structural method, so that learning a higher skill necessarily necessitates knowing the lower skill in the pyramid. The cognitive scope relates to knowledge, thinking, analysis, and application on a subject, which is what the educational system in general and the school curricula depend on through the lessons and applications that are mentioned on them.

Today's world differs from that reflected in Bloom's taxonomy in 1956. Despite this fact, teachers have learned a great deal about how students learn and teachers practice teaching and now realize that both teaching and learning are not just about thinking. They include the feelings and beliefs of students and teachers as well as the social and cultural environment of the classroom.

Several cognitive psychologists have worked to make the basic classification of thinking skills more relevant and accurate. Marzano [15] drew attention to the criticism of Bloom's taxonomy as he worked on developing his classification of educational goals. The research does not support the basic structure of the classification, which begins with the simplest level of knowledge and ends with the most difficult level of evaluation. Each skill that occupies a higher position in the classification with a hierarchy consists of fewer skills,

meaning that cognition requires knowledge and application requires cognition, knowledge, etc. In Marzano's view, this simply does not represent the truth of cognitive processes in Bloom's taxonomy.

The founders of the original six thinking processes assumed that complex projects could be distinguished because they required one process more than other processes. The task is originally a task of "analysis" or "evaluation." This has been proven incorrect, which explains why teachers are difficult to classify activities and challenge their difficulties and learn using classification. Anderson and Krathwohl [16] attempt to demonstrate that all complex learning activities require the use of different and multiple cognitive skills.

Bloom's classification included strengths and weaknesses like any theoretical model. The strong point is that this classification contains a very important topic in terms of thinking and puts the structure of its topics on this basis that practitioners can use. These teachers—who maintain a list of question-based stimuli related to the different levels of Bloom's taxonomy—undoubtedly encourage their students to practice higher-order thinking skills than these teachers who do not maintain this mechanism. On the other hand, anyone who has worked with teachers in classifying questions and learning activities according to what is in the classification can attest to the validity of a little consensus about what intuitive terms such as "analysis" or "evaluation" mean. Moreover, it is not possible to link a large number of worthwhile activities such as real problems and projects and classification, and attempting to do so will reduce its efficiency as learning opportunities.

Referenced Bloom's taxonomy in Anderson [17] and his colleagues published an updated version of Bloom's taxonomy (Figure 1) that takes into account a wide range of factors that affect the teaching and learning process. In this classification revision, they attempted to correct some of the errors in the original classification. Unlike the 1956 edition, the new classification distinguishes between "knowing what," meaning the content of thinking, and "knowing how," that is, procedures used to solve problems.

The knowledge dimension represents "knowledge of what." It includes four categories: real, conceptual, procedural, and cognitive. Real knowledge includes separate pieces of information, such as vocabulary definitions and information about specific details. Conceptual knowledge contains information systems, such as classifications and categories.

Procedural knowledge includes algorithms, experimental approaches, or approximation rules, methods, and information about when to use these procedures. Metacognitive knowledge refers to knowledge related to thinking processes and information about how to effectively control these processes. The cognitive process dimension of Bloom's revised taxonomy includes six skills, such as the original version. They range from the simplest to the most complex: (1) remembering, (2) understanding, (3) application, (4) analysis, (5) evaluation, and (6) creativity. Remembering includes identifying appropriate information and retrieving it from long-term memory. Understanding represents the ability to create your own meaning from educational

materials such as reading and teacher explanations. Secondary skills for this process include interpretation, examples, classification, summarization, reasoning, comparison, and explanation. The third process, application, refers to the procedure learned in a familiar or new situation.

The next process is an analysis that includes dividing knowledge into its own parts and thinking about how the parts relate to its overall structure. Students analyze discrimination, organization, and proportions. The evaluation tops the original classification and represents the fifth of six processes in the revised version. It includes review and criticism.

Creativity is a process that is not included in the old classification and the most important component of the new version. This skill involves putting things together to find something new. To get the job done, learners create, plan, and produce. Each level of knowledge can correspond to each level of the cognitive process according to this classification. Therefore, the student can remember real or procedural knowledge, understand conceptual or metacognitive knowledge, or analyze metacognitive or real knowledge. According to Anderson and his colleagues, "serious education provides students with the knowledge and cognitive processes they need to reach a successful solution to problems."

4.2. Bloom's Taxonomy and Assessment. The purpose of Bloom's taxonomy is to provide a framework, or organization, for classifying classroom lesson objectives because teachers can build their lessons through Bloom's taxonomy and support teachers to help their students [18].

The examination system that has been in effect for more than a century and a half depends on measuring student performance. Students who make the least mistakes get grade A, those who follow them receive grade B, and most students get grade C, but those below average get an estimate D. Those who obtain grades that do not qualify them for success will receive an E for failing. The assumption here was that graphing student results would result in a regular bell curve. Rather, the important thing is to help students achieve the goals of the curriculum they are studying, and in order for us to do so, the educational process should be directed toward planning missions that serve this purpose. Creative education is the product of this idea, and according to Bloom, education here has to take into account individual differences in learning, not to set fixed dates for the start and end of the study and fail of some students at the end of the school year. The teaching and learning process is not lethargic, and students should discuss or help each other; thus, feedback and reinforcement are simultaneous.

The bottom line is that curriculum planning and teaching methods should be appropriate to achieve these goals, and then the appropriate evaluation is based on Bloom who has been more aware of the complexity in the performance of students, and he was afraid of exaggerating its simplification to become based on the degrees achieved by students in the performance schedule prepared for their testing. Therefore, test developers should develop tests that

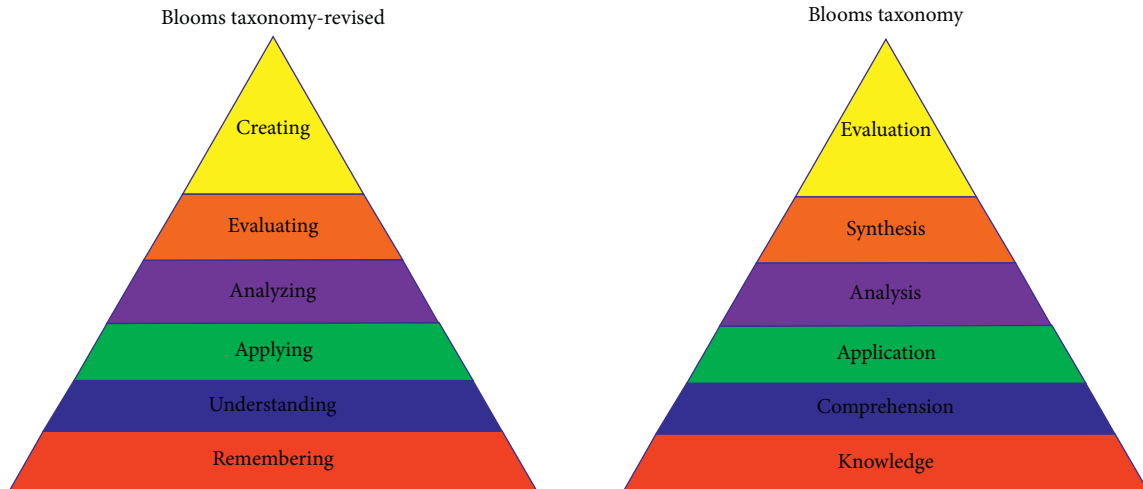


FIGURE 1: Bloom's taxonomy: then and now.

measure students' actual performance and limit their ability to pass the grade level.

4.3. The Educational Objectives of Secondary Schools in Kuwait. In this study, it was important to analyze the method of evaluation that determines students' future. Science, as mentioned earlier, is an interdisciplinary subject and it helped in examining, analyzing, and exploring Bloom's taxonomy within the same subject. In order to judge whether the extension of the science curriculum achieves its objectives, it is necessary to have the appropriate standards in each and undergo a continuous evaluation process, especially for the final examinations. Therefore, the researchers obtained the general education statement from MOE that entailed all three domains as in Figure 2. In addition to Bloom's taxonomy, the educational objectives in the secondary schools of Kuwait consist of Krathwohl's affective domain taxonomy and Harrow's psychomotor domain.

Krathwohl's affective domain taxonomy (Figure 2) does not differ from the cognitive objectives, and it is also divided into levels in a form of hierarchy related to feelings and social-emotional objectives. The affective domain starts from the level of receiving where students are aware to the surrounding and the existence of certain ideas; then, responding to the ideas and concepts moving to valuing where students are willing to be perceived by their classmates and their community in general as they express their ideas; next, the organization where students relate their perspective to general theories and harmonize it; and last characterization by value to fit within the values they have internalized. On the other hand, psychomotor learning can be explained as demonstrating proficiency in a certain skill. Accomplishment is observed at the last level by the degree to which the skills are internalized, so that tasks are completed dependably. In sum, secondary students at the State of Kuwait are supposed to experience all three domains to achieve the educational objective in a certain subject and yet get assessed by them [19].

5. Method

In this research, the content analysis method was used as one of the descriptive methods, given its suitability to achieve the study goals and to answer its questions represented in the analysis of final examination questions. In describing phenomena in a conceptual form, content analysis is primary because it views the data as representations to be seen, read, and interpreted for better understanding [20]. Vaismoradi et al. [20] stated that the content analysis method depends on systematic coding and categorizing to determine trends and patterns which helps in describing the characteristics of phenomena. Since there are not enough studies about the test and examinations based on Bloom's taxonomy, the content analysis method is used to describe the test questions.

5.1. Sample. The sample consisted of the entire study community, which included all questions in the final examinations for science subjects (chemistry, physics, and biology) as listed in Table 1. The analysis sample included all the examination questions for the second period of the academic year 2018-2019.

5.2. Building up the Instrument. The content analysis tool consisted of all types of questions that were asked in all of the examinations such as a list of question categories, criteria, and subindicators. It also included the objective of the analysis process, the sample of analysis, the unit of analysis and its categories, the controls of the analysis process, and the analysis form, in order to monitor the frequency of the types of questions in each final examination. It determined the goal of the analysis: the content analysis process aims to determine the types of questions in the final examinations for science subjects (chemistry, physics, and biology) in the State of Kuwait and calculate their percentages. After that, researchers determined the categories of analysis: the categories of questions were relied on in their fields, nature, types, and levels. It was also important to define the unit of

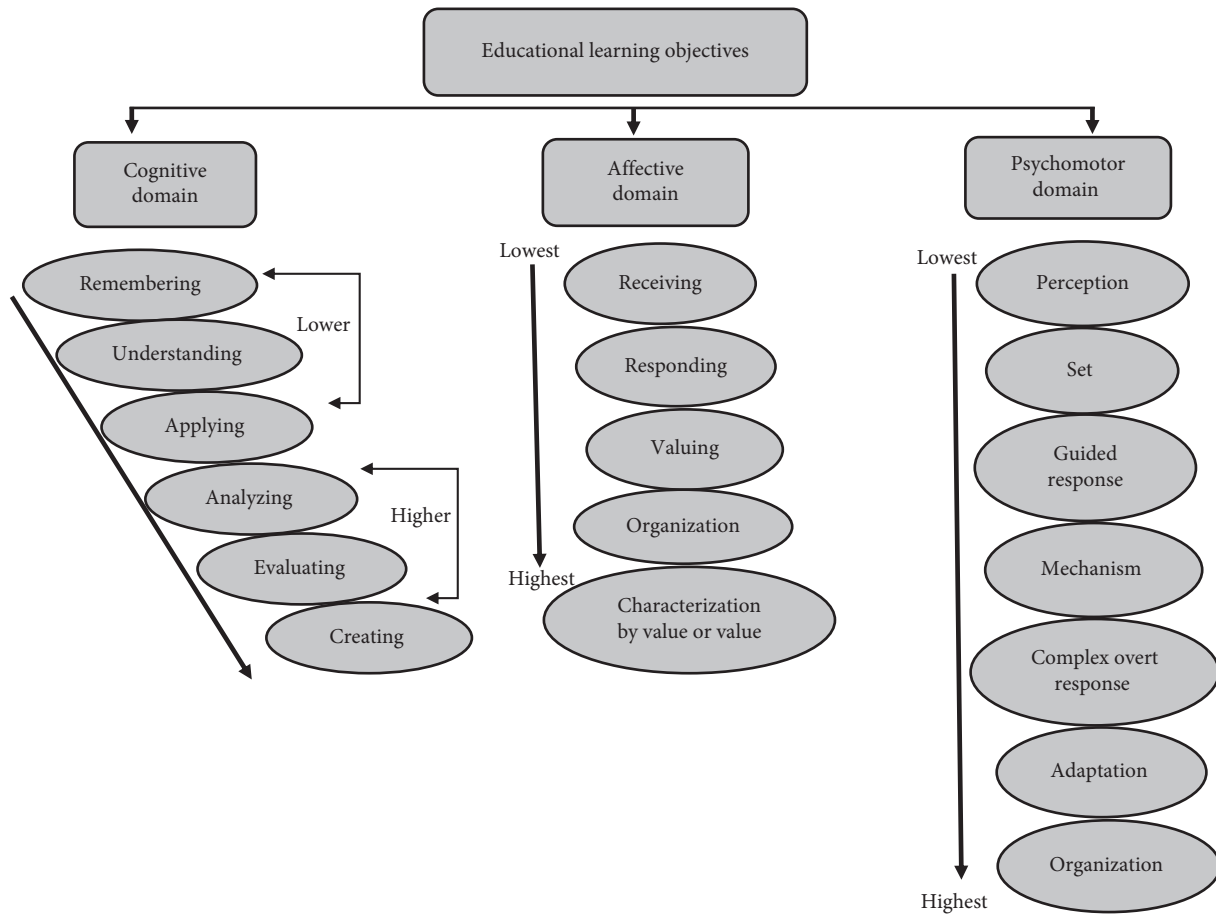


FIGURE 2: Educational learning objectives.

TABLE 1: Description of the final examinations for science (chemistry, physics, and biology).

| Subject | Number of questions | Number of subquestions | Number of pages | Time duration | Total grade |
|-----------|---------------------|------------------------|-----------------|---------------|-------------|
| Chemistry | 6 | 46 | 12 | 2 hours | 56 |
| Physics | 6 | 48 | 48 | 2 hours | 56 |
| Biology | 6 | 42 | 42 | 2 hours | 56 |

analysis: the subquestion was chosen as a unit of analysis, due to its suitability of the objective of the analysis process. The field of question is determined according to its content, its nature required, and the type of response specified, and it is classified in more than one category, but only in one type of one category. The analysis is carried out within the framework of the content and procedural definition of each type of question and each level of its indicators. Researchers also divided each major question into a number of sub-questions, so that each question includes one specific requirement. Also, we used these definitions to help us in the process of categorizing questions of each examination.

For the coding process and analyzing the examinations, we have defined the following to assure consistency while coding:

- (i) Cognitive (cognitive) questions: questions focused on scientific knowledge and cognitive skills and consists of six levels according to Bloom's pyramid:

memory, understanding, application, analysis, synthesis, and evaluation

- (ii) Substantive questions: questions with specific answers that are not subject to the degree to be answered for the corrected personality and include multiple-choice questions, true/false questions, and fill in the blank questions
- (iii) Essay questions: questions requiring extended answers enable the respondent to express his or her own opinions, allowing the degree given to be influenced by the self-corrector
- (iv) Science Operations Questions: questions that focus on measuring the organized scientific activities that learners perform during the course of reaching and judging results and represent the behavior of the science world and include operations: observation, identification, classification, conclusion, the definition of scientific terms, interpretation, and

comparison, scientific expression, prediction, hypothesis, and derivation

Finally, for the validity and reliability of the analysis, the process and the results were discussed and confirmed by a group of experts in the science, measurement, and evaluation methods.

5.3. *Data Analysis and Results.* In this section, data analysis was conducted to answer the following:

What are the types of secondary school (chemistry, physics, and biology) examination questions? More specifically:

- (i) What is the ratio of the three educational objectives areas (cognitive, psychomotor, and emotional) among the subjects (chemistry, physics, and biology) in the final examinations?
- (ii) What is the representation of the levels of knowledge in accordance with Bloom's taxonomy in each examination?
- (iii) What is the representation of the types of questions (objective, essay) in each examination?
- (iv) What is the representation of the questions of each examination for every field of science (chemistry, physics, and biology) in the State of Kuwait for the relative importance of science books units for the twelfth grade?

Frequencies and percentages for questions of final examinations according to the areas of educational goals and cognitive psychomotor and affective domains are shown in Tables 2 and 3.

It is clear from Tables 2 and 3 that the questions of secondary school examinations for the subjects of science (chemistry, physics, and biology) concentrated on the cognitive domain, and it was completely devoid of the questions of the psychoemotional fields, which can be explained on the knowledge side only in the examinations of secondary school for science subjects (chemistry, physics, and biology) to the compliance of the authors of the final examinations with the examination system in the secondary school in Kuwait, which focused on the cognitive aspect, scientific knowledge, and their achievement, and the reason may be the fact that it neglects the questions that are kinetic and sentimental to the nature of the content and it focused on facts, concepts, generalizations, laws, and scientific theories that call for cognitive processes. In addition, the final examinations are restricted to a specific time that has not been exceeded or increased for ten years (previous data, a two-hour examination material science (chemistry, physics, and biology)). Ratios of representation of levels of knowledge field according to the Bloom pyramid were measured by secondary school examination questions in science subjects (chemistry, physics, and biology). The frequencies and percentages of the questions of each final examination according to the levels of knowledge are shown in Tables 4 and 5.

It is clear from Tables 4 and 5 that the science (chemistry, physics, and biology) examination questions for the period

TABLE 2: Final examinations' question distribution for chemistry, physics, and biology based on course objectives.

| Subject | Chemistry | | Physics | | Biology | |
|-------------|------------|-----|----------|-----|----------|-----|
| | <i>F</i> * | % | <i>F</i> | % | <i>F</i> | % |
| Field | | | | | | |
| Knowledge | 46 | 100 | 48 | 100 | 42 | 100 |
| Psychomotor | — | — | — | — | — | — |
| Affective | — | — | — | — | — | — |
| Total | 46 | 100 | 48 | 100 | 42 | 100 |

TABLE 3: Final examinations' question distribution for chemistry, physics, and biology based on grades for each set of objectives.

| Subject | Chemistry | | Physics | | Biology | |
|-------------|-----------|-----|---------|-----|---------|-----|
| | Grade | % | Grade | % | Grade | % |
| Field | | | | | | |
| Knowledge | 56 | 100 | 56 | 100 | 56 | 100 |
| Psychomotor | — | — | — | — | — | — |
| Affective | — | — | — | — | — | — |
| Total | 56 | 100 | 56 | 100 | 56 | 100 |

F = frequency.

TABLE 4: Final examinations' question distribution for chemistry, physics, and biology based on each level.

| Subject | Chemistry | | Physics | | Biology | | Total | |
|---------------|-----------|------|----------|------|----------|------|----------|------|
| | <i>F</i> | % | <i>F</i> | % | <i>F</i> | % | <i>F</i> | % |
| Level | | | | | | | | |
| Remembering | 15 | 32.6 | 22 | 45.8 | 15 | 35.7 | 52 | 38.2 |
| Understanding | 20 | 43.5 | 18 | 37.5 | 22 | 52.4 | 60 | 44.1 |
| Analysis | 11 | 23.9 | 8 | 16.7 | 5 | 11.9 | — | 17.6 |
| Evaluation | — | — | — | — | — | — | — | — |
| Total | 46 | 100 | 48 | 100 | 42 | 100 | 112 | 100 |

TABLE 5: Final examinations' grade distribution for chemistry, physics, and biology based on grades for each level.

| Subject | Chemistry | | Physics | | Biology | |
|---------------|-----------|------|----------|------|----------|------|
| | <i>F</i> | % | <i>F</i> | % | <i>F</i> | % |
| Level | | | | | | |
| Remembering | 13 | 23.2 | 16.5 | 29.5 | 17 | 30.4 |
| Understanding | 28.5 | 50.9 | 11 | 19.6 | 29 | 51.8 |
| Analysis | 14.5 | 25.9 | 28.5 | 50.9 | 10 | 17.9 |
| Evaluation | — | — | — | — | — | — |
| Total | 56 | 100 | 56 | 100 | 56 | 100 |

2018-2019 have focused on five levels: remembering, understanding, applying, analyzing, and constructing, but the two levels of understanding were combined and the application as well as the levels of analysis and synthesis. Researchers found that chemistry examination questions have ratios of 32.6%, 43.5%, and 23.9% according to the number of questions and ratios of 23.2%, 50.9%, and 25.9%, respectively, according to the assigned grades. Physics examination questions have ratios of 45.8%, 37.5%, and 16.7%, respectively, according to the number of questions and ratios of 29.5%, 19.6%, and 50.9%, respectively, according to assigned degrees. The biology examination questions have

ratios of 35.7%, 52.4%, and 11.9%, respectively, according to the assigned grades.

The percentages of representation of the types of questions (short answers, essay question) were measured by the examinations of the general secondary certificate examinations in science subjects (chemistry, physics, and biology). The frequency and percentages of each examination's final examination questions according to the types of questions are shown in Tables 6–11.

It is clear from Tables 6 and 7 that the examinations of science subjects (chemistry, physics, and biology) for the year 2018-2019 have focused on two types, namely, objective essay. Researchers found that the distribution of chemistry examination questions was at rates of 54.3% and 45.7%, respectively, according to the number of questions and at rates of 39.3% and 60.7%, respectively, according to the grades assigned to each type. Physics examination questions have 58.3% and 41.7%, respectively, according to the number of questions and 35.7% and 64.3%, respectively, according to the grades assigned to each type. The biology examination questions have 47.6% and 52.4%, respectively, according to the number of questions and 35.7% and 64.3%, respectively, according to the grades assigned to each type. It turned out that the percentage of distribution of examination questions with their objective type exceeded 50% in the subjects of chemistry (54.3%) and physics (58.3%), while its percentage in the biology test decreased (47.6%). In contrast to that, researchers found that the percentage of distribution of examination questions by type is less than 50% in chemistry (45.7%) and physics (41.7%), while the percentage increases in biology testing (52.4%). Researchers also found that the percentage of test questions with their objective type is less than 40% in all three subjects: chemistry (39.3%), physics (35.7%), and biology (35.7%). In contrast, we find that the percentage of scores for examination questions with their pans is more than 60% in all three subjects: chemistry (60.7%), physics (64.3%), and biology (64.3%). And it is accepted that the scores for the objective type questions are 40% and the type for essay questions is 60%.

It is clear from Tables 8 and 9 that the science examination questions (chemistry, physics, and biology) for the year 2018-2019 have focused on five types: the scientific term, multiple choice, fill in the blank, right or wrong, and answer about the required. Researchers found that the distribution of chemistry examination questions is at rates of 24.0%, 24.0%, 28.0%, 24.0%, and 0.0%, respectively, according to the objective type and at rates of 20.5%, 27.3%, 31.8%, 20.5%, and 0.0%, respectively, according to custom grades. Physics examination questions have rates of 17.9%, 42.9%, 17.9%, 21.4%, and 0.0%, respectively, according to the objective type and rates of 12.5%, 60.0%, 12.5%, 15.0%, and 0.0%, respectively, according to the grades assigned. The biology examination questions have rates of 30.0%, 30.0%, 0.0%, 20.0%, and 20.0%, respectively, according to the objective type and rates of 30.0%, 30.0%, 0.0%, 20.0%, and 20.0%. It turned out that the distribution of examination questions in the chemistry and physics subjects focused on the scientific term, multiple choice, fill in the blank, and true or false, while in the biology test, the distribution of

TABLE 6: Final examinations' grade distribution for chemistry, physics, and biology based on type.

| Subject | Chemistry | | Physics | | Biology | |
|-------------|-----------|------|----------|------|----------|------|
| | <i>F</i> | % | <i>F</i> | % | <i>F</i> | % |
| Type | | | | | | |
| Substantive | 25 | 54.3 | 28 | 58.3 | 20 | 47.6 |
| Long answer | 21 | 45.7 | 20 | 41.7 | 22 | 52.4 |
| Total | 46 | 100 | 48 | 100 | 42 | 100 |

TABLE 7: Final examinations' grade distribution for chemistry, physics, and biology based on type.

| Subject | Chemistry | | Physics | | Biology | |
|-------------|-----------|------|---------|------|---------|------|
| | Grade | % | Grade | % | Grade | % |
| Type | | | | | | |
| Substantive | 22 | 39.3 | 20 | 35.7 | 20 | 35.7 |
| Long answer | 34 | 60.7 | 36 | 64.3 | 36 | 64.3 |
| Total | 56 | 100 | 56 | 100 | 56 | 100 |

TABLE 8: Final examinations' frequency distribution of substantive questions for chemistry, physics, and biology.

| Subject | Chemistry | | Physics | | Biology | |
|-------------------|-----------|------|----------|------|----------|------|
| | <i>F</i> | % | <i>F</i> | % | <i>F</i> | % |
| Questions | | | | | | |
| Definition | 6 | 24.0 | 5 | 17.9 | 6 | 30.0 |
| Multiple choice | 6 | 24.0 | 12 | 42.9 | 6 | 30.0 |
| Fill in the blank | 7 | 28.0 | 5 | 17.9 | — | — |
| True–false | 6 | 24.0 | 6 | 21.4 | 4 | 20.0 |
| Short answers | — | — | — | — | 4 | 20.0 |
| Total | — | 100 | — | 100 | — | 100 |

TABLE 9: Final examinations' grading distribution of substantive questions for chemistry, physics, and biology.

| Subject | Chemistry | | Physics | | Biology | |
|-------------------|-----------|------|---------|------|---------|------|
| | Grade | % | Grade | % | Grade | % |
| Questions | | | | | | |
| Definition | 4.5 | 20.5 | 2.5 | 12.5 | 6 | 30.0 |
| Multiple choice | 6 | 27.3 | 12 | 60.0 | 6 | 30.0 |
| Fill in the blank | 7 | 31.8 | 2.5 | 12.5 | — | — |
| True–false | 4.5 | 20.5 | 3 | 15.0 | 4 | 20.0 |
| Short answers | — | — | — | — | 4 | 20.0 |
| Total | 22 | 100 | 20 | 100 | 20 | 100 |

questions focused on the scientific term, multiple choice, right or wrong, and answer the required.

Tables 10 and 11 showed that the questions of the type for science subject examinations (chemistry, physics, and biology) for the year 2018-2019 have focused on thirteen types, namely, what is meant, problem solving, choose from the group, ills (Explain), complete the blank, compare, answer the following, explain by writing the equations, what to expect, mention the factors, infer a relationship, what is important, and study the figure. The two questions “choose from the group” and “fill in the blanks” were considered short answer type. Researchers found that the distribution of chemistry examination questions is 14.3%, 9.5%, 4.8%, 14.3%, 14.3%, 9.5%, 4.8%,

TABLE 10: Final examinations' frequency distribution of long answer questions for chemistry, physics, and biology.

| Subject | Chemistry | | Physics | | Biology | |
|---|-----------|------|---------|------|---------|------|
| | F | % | F | % | F | % |
| Questions | | | | | | |
| What does it mean? | 3 | 14.3 | 2 | 10.0 | 3 | 30.0 |
| Solve the following problem case | 2 | 9.5 | 4 | 20.0 | — | 13.6 |
| Choose from the following | 1 | 4.8 | — | — | — | — |
| Explain with reasons | 3 | 14.3 | 4 | 20.0 | 3 | 13.6 |
| Fill in the blank | 3 | 14.3 | — | — | 4 | 18.2 |
| Comparison | 2 | 9.5 | 2 | 10.0 | 3 | 13.6 |
| Answer the following questions | 1 | 4.8 | — | — | 3 | 13.6 |
| Write an equation | 4 | 19.0 | — | — | — | — |
| What do you expect? | 2 | 9.5 | 2 | 10.0 | — | — |
| List the factors | — | — | 2 | 10.0 | — | — |
| Write a conclusion | — | — | 1 | 5.0 | — | — |
| What is the importance of? | — | — | — | — | 3 | 13.6 |
| Study the figure, then answer the questions | — | — | 3 | 15.0 | 3 | 13.6 |
| Total | 21 | 100 | 20 | 100 | 22 | 100 |

TABLE 11: Final examinations' grading distribution of long answer questions for chemistry, physics, and biology.

| Subject | Chemistry | | Physics | | Biology | |
|---|-----------|------|---------|------|---------|------|
| | Grade | % | Grade | % | Grade | % |
| Questions | | | | | | |
| What does it mean? | 3 | 8.8 | 8 | 12.5 | 3 | 8.3 |
| Solve the following problem case | 6 | 17.6 | 10 | 60.0 | — | — |
| Choose from the following | 2.5 | 7.4 | — | — | — | — |
| Explain with reasons | 3 | 8.8 | 6 | 16.7 | 6 | 16.7 |
| Fill in the blank | 7 | 20.6 | — | — | 6 | 16.7 |
| Comparison | 4 | 11.8 | 2 | 5.6 | 3 | 8.3 |
| Answer the following questions | 2.5 | 7.4 | — | — | 9 | 25.0 |
| Write an equation | 4 | 11.8 | — | — | — | — |
| What do you expect? | 2 | 5.9 | 3 | 8.3 | — | — |
| List the factors | — | — | 2 | 5.6 | — | — |
| Write a conclusion | — | — | 2 | 5.6 | — | — |
| What is the importance of? | — | — | — | — | 3 | 8.3 |
| Study the figure, then answer the questions | — | — | 3 | 8.3 | 8 | 16.7 |
| Total | 34 | 100 | 36 | 100 | 38 | 100 |

19.0%, 9.5%, 0.0%, 0.0%, 0.0%, and 0.0%, respectively, by proportions. Physics examination questions have a rate of 10.0%, 20.0%, 0.0%, 20.0%, 0.0%, 10.0%, 0.0%, 0.0%, 10.0%, 10.0%, 5.0%, 0.0%, and 15.0%, respectively, by proportions and 5.6%, 44.4%, 0.0%, 16.7%, 0.0%, 5.6%, 0.0%, 0.0%, 8.35.9%, 5.6%, 5.6%, 0.0%, and 8.3%, respectively, according to grades assigned. Also, biology examination questions have a rate of 13.6%, 0.0%, 0.0%, 13.6%, 18.2%, 13.6%, 13.6%, 0.0%, 0.0%, 0.0%, 0.0%, 13.6%, and 13.6%, respectively, and 8.3%, 0.0%, 0.0%, 16.7%, 16.7%, 8.3%, 25.0%, 0.0%, 0.0%, 0.0%, 0.0%, 8.3%, and 16.7% by proportions. It turned out that the distribution of examination questions in chemistry focused on what is meant, solving a problem, choose from the group, reason (explain), complete the blanks, compare, answer the following, clarify by writing the equations, and what do you expect, and the physics subject focused on what is the intended, problem solving, reasoning

(interpretation), comparison, what to expect, mention factors, infer a relationship, and study the figure. In the biology examination, the distribution of questions focused on what is meant, reason (explain), fill in the blanks, compare, answer the following, what is important, and study the figure.

According to the researchers, the frequency and percentages of the types of questions for each of the final examinations are shown in Tables 12 and 13. It is clear from Tables 12 and 13 that the distribution of questions of the objective and pane types of science subject examinations (chemistry, physics, and biology) for the year 2018–2019 has focused on three units for each subject.

It is clear from Tables 14–16 that the chemistry examination has the relative importance of the fourth and fifth units, while covering the fourth unit more than its relative importance. But covering the fifth unit was less than its relative importance. Researchers took into account the

TABLE 12: Question distribution based on the wage of importance in each unit in the textbook.

| Subject Unit | Chemistry | | Physics | | Biology | |
|-----------------|-----------|------|----------|------|----------|------|
| | <i>F</i> | % | <i>F</i> | % | <i>F</i> | % |
| One | 20 | 43.5 | 18 | 52.9 | 22 | 52.4 |
| Two | 26 | 56.5 | 6 | 17.7 | 8 | 19.0 |
| Three | — | — | 10 | 29.4 | 12 | 28.6 |
| Total | 46 | 100 | 34 | 100 | 42 | 100 |

TABLE 13: Distribution of final examinations questions' scores for the second period of the academic year 2018-2019, its frequencies, and percentages according to its importance for each unit in the textbook.

| Subject Unit | Chemistry | | Physics | | Biology | |
|-----------------|-----------|------|---------|------|---------|------|
| | Grade | % | Grade | % | Grade | % |
| Unit 1 | 26.75 | 47.8 | 22.5 | 40.2 | 30 | 53.6 |
| Unit 2 | 29.25 | 52.2 | 7 | 12.5 | 10 | 17.8 |
| Unit 3 | — | — | 26.5 | 47.3 | 16 | 28.6 |
| Total | 56 | 100 | 56 | 100 | 56 | 100 |

TABLE 14: Chemistry textbook topics based on units.

| | Number of topics | Number of pages | Relative importance* | Number of classes per semester | Relative importance** | Average relative importance |
|--|------------------|-----------------|----------------------|--------------------------------|-----------------------|-----------------------------|
| Unit 1: Salts and calibration of acids and bases | 5 | 46 | 41.4 | 17 | 47.2 | 44.3 |
| Unit 2: Hydrocarbon derivatives | 5 | 65 | 58.6 | 19 | 52.8 | 55.7 |
| Total | 10 | 111 | 100 | 36 | 100 | 100 |

*The relative importance of the number of pages. **The relative importance of the number of shares.

TABLE 15: Physics textbook topics based on units.

| | Number of topics | Number of pages | Relative importance* | Number of classes per semester | Relative importance** | Average relative importance |
|--|------------------|-----------------|----------------------|--------------------------------|-----------------------|-----------------------------|
| Unit 1: Electricity and magnetism | 4 | 54 | 43 | 18 | 46.2 | 44.6 |
| Unit 2: Electrons | 2 | 25 | 20 | 7 | 17.9 | 19 |
| Unit 3: Atomic physics and nuclear physics | 5 | 46 | 37 | 14 | 35.9 | 36.4 |
| Total | 11 | 125 | 100 | 39 | 100 | 100 |

TABLE 16: Biology textbook topics based on units.

| | Number of topics | Number of pages | Relative importance* | Number of classes per semester | Relative importance (%)** | Average relative importance (%) |
|--------------------------------------|------------------|-----------------|----------------------|--------------------------------|---------------------------|---------------------------------|
| Unit 1: DNA, genes and chromosomes | 11 | 44 | 46.8 | 19 | 48.7 | 47.7 |
| Unit 2: The biotechnology revolution | 5 | 19 | 20.2 | 9 | 23.1 | 21.7 |
| Unit 3: The human genome | 6 | 31 | 33 | 11 | 28.2 | 30.6 |
| Total | 22 | 94 | 100 | 39 | 100 | 100 |

relative importance of the second, third, and fourth units of the physics examinations and to a greater degree the second unit. As for the biology examinations, the relative importance of the first three units, the second and the third units, was

taken into consideration, except for the first unit, which was covered by more than its relative importance, and on the contrary, for the second and third units, which were covered by less than their relative importance.

6. Discussion and Conclusion

The result of this study based on Tables 2–16 indicated many issues related to teaching for testing rather than teaching for understanding. It also shows that students are being taught to be tested, so the practice of learning may not take place in the learning process.

First, all science fields' examinations for the year 2018–2019 did not match the relative importance of their textbooks. This may be due to the fact that it is difficult to accurately represent the content in two hours. The limitation of representing all topics in one summative examination is almost impossible. It may be also due to the nature of science as a subject that cannot be represented in an examination for a couple of hours. The result of this research coincided with [12] and [11] in that the objectives of Kuwaiti schools' science curriculum were only focused on the lower cognitive aspects, neglecting the other two domains of learning.

Further, it was noted in Table 4 that most questions were based on knowing and understanding levels, and the higher levels of thinking questions were not noticeable and unrepresented well in the final examinations of all science subjects. As mentioned in the literature review, [11] concluded that the curriculum objectives tend to focus on the lower cognitive domain. The type of questions, their nature, and the cognitive levels that final examinations measure are the factors that determine the way students take up their study of the scientific knowledge, methods, and practices of science. So, if examination questions are concerned with the ideas and aspects of lower cognitive levels, then the learning process will be very limited and may not prepare students for the next level after their graduation. Unfortunately, data analysis showed that almost all the final examinations are limited to textbooks which means limiting the concepts of higher thinking and application in science. Previously, in the conceptual framework section, Blooms was worried about exaggerating its simplification to become based on the degrees achieved by students in the performance schedule prepared for their testing, and that is the case of the assessment at the examination system at MOE. Also, the objectives of the educational process may not take place due to the restricted and narrow framework of the final examinations. Curriculum objectives need to be unambiguous and precise, are able to be measured in the assessment clearly, are formulated, and must cover all learning domains encompassing the cognitive, affective, and psychomotor aspects and that was missing as per the results of this study.

Therefore, researchers concluded with the need for revisiting the mechanism of writing the final examinations and base it on standards covering all domains since the examination is only a reflection of the school textbook. Students must be tested and evaluated based on concepts not memorizing sets of facts from textbooks. This study is meant to pave the way to have more insight and more in-depth studies about the assessment tools in the education system for secondary schools of the State of Kuwait. It will also help test developers with sufficient data and statistics about the level of examinations and extent to goals that are required to achieve and work to avoid deficiencies. While there is no

national assessment mechanism for high school students or any international benchmark such as PISA, it would be reasonable to rethink the validity of the high school assessment examinations.

6.1. Recommendations. Assessments are one of the most important reasons for the advancement of the educational process in its comprehensive framework, given the importance of this in the correct measurement and evaluation of the student, and therefore, we recommend the following:

- (i) The necessity of focusing on concepts of chemistry, physics, and biology during examinations rather than the relative importance of the textbooks
- (ii) The need for the Ministry of Education to adopt a clear policy for examinations and to follow a preset schedule of specifications
- (iii) Create a bank for test questions to include a large number of questions of chemistry, physics, and biology, to be selected and organized according to predefined criteria and in a scientific way and cover all of the levels of Bloom's taxonomy
- (iv) Developing a system for the final examinations for high school based on a set of standards rather than narrowed objectives related to textbooks
- (v) Supervisors should consider constructing a more holistic approach in applying all three domains of learning in constructing valid assessment

6.2. Implications for Further Studies. This study is descriptive and did not go in-depth; therefore, further studies can be recommended such as run regression among students' success or surveys for both teachers and school communities including parents and students. This study only analyzed one school year's final examinations, and researchers may compare it with future examinations.

Data Availability

The data are available at the Ministry of Education of the State of Kuwait.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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