

# ASSESSMENT OF SCIENCE PRESERVICE TEACHERS PERFORMANCE / BASIC EDUCATION COLLEGES ACCORDING TO NSTA CONTENT KNOWLEDGE STANDARDS

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**ABSTRACT:** *The current research aims to identify the performance of Science Department Preservice Teachers / Basic Education Colleges according to the content knowledge of NSTA standards, to diagnose the strengths and weaknesses in its performance. This work adopted the descriptive approach. The sample of the study reached (100) students. The preservice teachers' performance in the schools and their effect was observed by the researcher through the note card of the content knowledge standard (one of NSTA standards). After conducting the statistical operations, the researcher found that there is a set of indicators within the content knowledge standard are met and others are not met. He reached to conclusions, recommendations and proposals related to the research subject.*

**Keywords:** Assessment, Performance, Preservice Teachers, NSTA Standards

**The Problem of the study:** The issue of preservice teachers' education is not easy, because it requires keeping pace with scientific progress and rapid technological development in various fields of science and knowledge. Moreover, there is a remarkable and clear development in the preparation and training programs in line with the requirements of modern times. The best evidence for that is what Arab Organization for Education, Culture and Science (ALECSO) called for. Efforts are needed to prepare science teachers well in academic and professional terms, according to the possibilities available [1].

Therefore, the researcher assumes that the teacher preparation process should not be limited to providing them with theoretical knowledge and information, because it is not sufficient to prepare a successful teacher in the future, and the teaching profession has its cognitive and performance competencies. Based on the above, the researcher thinks that the problem lies in the preservice teacher performance and how to improve it. Thus, the researcher touched on this problem by looking at the preservice teachers' evaluation form; he found that it is not inclusive of all aspects related to competencies and skills that teachers need in order to teach in the classroom.

**Significant:** The raising of education level is one of the conditions of any progress or social or technological development, or others. The best evidence of the importance of science and education for life and their impact, where such vocabularies are in the Quran first verses, The Almighty said: "Read! and thy Lord is most Bountiful, he Who taught (the use) of pen, - Taught man that which he knew not" (Al-Alaq 3: 5). If we carefully consider this verse, we find that the words (read, taught) have been repeated many times, this is a clear evidence on the virtue of science and learning to man, and urged by the Creator [2].

Then, the performance-based evaluation term is used to refer to the real assessment of multiple tasks, and the performance required and detailed in the targeted learning outcomes. It also allows the evaluator to observe in the course of performing tasks as practice and use of knowledge that he has learned either directly or through constructive learning, when he begins to realize new relationships that interrelate his learning with facts and concepts, and what he will learn in the near future [3].

Therefore, performance assessment for students is of great importance in the success of the educational process, because it is the behavior observed by learners at different

levels and stages. The preservice teacher performance can interact with the learners through learning process, and through such process, we can judge the success of the lesson to improve and strengthen the good performance, in order to correct the course of the education process, and to take advantage of the strengths using them in other educational situations. Hence, "Zaitoun" stressed that in order to complete the educational process in all aspects, preservice teachers performance and their learning ability assessment must be through objectives achieved, and to determine their efficiency of selecting methods and strategies that stimulate learners' thinking and motivate them to study, which leads to improve their scientific - educational level. This is reflected in their scientific thinking and behavior inside and outside the classroom [4]. The study assumes that the teacher is the basic pillar in the education process, because it is directly responsible in the educational institution for making changes desirable in learners' behavior, especially in the primary stage, because it is the first basis in the education process, where the student is like a "blank page" on which the teacher can engrave whatever he wants.

For the foregoing, the success of the educational process is linked to the preservice teachers' preparation. The best books, curricula, and school activities may not achieve goals unless the teacher is well prepared to possess teaching skills in order to translate them into educational behavior and experiences for his learners, interacting with them, developing their capacities, sharpening their experiences, and expanding their knowledge and mental abilities [5].

Therefore, the researcher sought to evaluate the preservice teacher performance in light of the content knowledge standard (one of NSTA standards), as well as that the assessment is part of the educational process, so it saves a lot of time, effort and money for the educational process and it is a feedback to be invested in the educational process development [6].

The performance is the lesson implementation and the teacher must combine the school curricula and the student social environment, and the employment and use of teaching methods that fit the curriculum and student scientific level, and the use of appropriate educational techniques and methods, as well as a behavior used by a person when doing something is likely that others cannot distinguish this work, while it can be distinguished by measuring the individual performance. The teaching can be

occurred and its output is the learning that can be measured when its performance is measured [7].

The standard is to clarify the potential level that has been established by the body charged with a certain objective, i.e. the level to be achieved to reach the widest area of quality, and that the standards have a significant importance, because they give a unified language and goal to continue to achieve the results and build an acceptable standard level, with no controversy to the educational work on all levels, and to show the student skills to reach many of the outputs and outcomes agreed upon previously, making the educational committee members diagnose the cultural and scientific level of students in the current time, develop current and subsequent educational plans effectively, and to identify and address negative aspects and support the positive aspect of the students' level [8].

The National Science Teachers Association (NSTA) is a large professional educational organization based in Virginia. Its mission is focused on science teachers, science curriculum developers, science educators and all those involved in the scientific development. This association has contributed to the building and dissemination of national standards for teaching science. The association publishes a number of periodical journals, including (Science Teacher), and it holds an annual conference[9].

National Science Teachers Standards have several functions, including a coherent view of what an individual is as a scientific scholar, describing what all students must understand and what they can do as a result of their accumulated learning experience[10].

The study assumes that the practice in Basic Education College has a positive effect. Students in the second semester of the third stage organize field visits to primary schools with the education supervisor specialized in teaching methods subject and teaching duration (4) hours per week for a whole semester to observe the practical teaching process in the classroom, and to give students skills through the direct observation in the classroom. Regarding the eighth semester, its actual practice begins in primary schools, where the teacher should spend three months in those schools practicing what they learned from theories in the academic and professional courses, and also exercise the actual practice in the classroom to develop their own abilities, and they are visited by educational supervisor specialized in teaching methods and the specialist supervisor. The practice helps qualify the teachers for the teaching profession, The objective of the current research is to identify the performance of Science Department preservice teachers / Basic Education Colleges according to the content knowledge of NSTA standards to diagnose the strengths and weaknesses of its performance.

**Limits:** The current research is limited to fourth-grade students in Department of Science / Basic Education College/ Mustansiriyah University for the academic year 2017-2018.

#### **Terminology Definition:**

1. **The assessment:** is the process that selects the appropriate information and analyzes for creating the data needed to make decisions and choosing appropriate alternative among a range of alternatives[11].

**Procedural :-** The process of issuing a judgment on the performance of science preservice teachers / Basic Education Colleges through a note card designed by the

researcher based on the content knowledge of NSTA standards, and by observing the preservice teachers in the primary schools.

2. **The Performance:** It is a behavior that is done with a certain amount of skill in a particular field, and requires appropriate training and preparation until one reaches the stage of empowerment [12].

**Procedural:** is the educational possibility and behaviors implemented by science preservice teachers / Basic Education Colleges, during the practical application of the science material in the school. The researcher observes the extent to which the content knowledge content (one of NSAT standards) is met and its indicators where the researcher prepared a note card accordingly. The preservice teachers are assessed in a certain degree which is used as milestones for each indicator. This depends on the extent to which (content knowledge standard) indicators are met during the practice.

3. **Preservice teachers:** They are students of the fourth stage in the humanities and educational colleges, who undertake the actual application process of the theoretical framework they acquired in the university to students of a school for a period of time according to programs prepared by the university or college in order to provide them with the necessary professional competencies that empower them to a practical life and make them successful teachers in the future [13].

#### **4. The study assumes the procedural definition of NSTA Standards:**

NSTA is an abbreviation for National Science Teachers Association. It is an American association that develops and improves standards and programs for pre-service science teachers' preparation. The association makes changes and updates on standards and revises them on a regular basis and the recent update on standards was in 2012. Each standard contains a set of specifications, characteristics and qualifications that must be possessed by preservice science teachers based on these standards, which are concerned with everything that goes on during the educational process.

#### **Theoretical Aspects:**

**Performance Assessment:** The performance assessment first appeared during the First World War, specifically when it was used in the industry. Therefore, supervisors adopted a system called "Merit Rating" or other called "Employee Evaluation" or "Performance/ Efficiency Evaluation", to determine wages of employees who were working on what they produced per hour. With the development of management methods over the time, the performance assessment importance was increased, but its function did not crystallize until the recent time, as it is considered a key element in the development of workers and their efficiency [14].

The performance assessment process has received great attention from the administration because it is the effective way to correct the course of any administrative process: it is the basis for choosing the correct method of construction and development through the continuous measurement of management effectiveness in achieving its objectives [15].

#### **Performance Assessment Steps:**

1. Determine performance standards for the side to be assessed.

2. Prepare the necessary tools to gather information and data related to the target and to indicate their destination.
3. Gather information using appropriate tools and by well-trained people.
4. Analyze preliminary data in ways that ensure obtaining an objective and clear picture of the situation, reality or side being evaluated.
5. Explain the results reached through the objective analysis of the data and in light of the specific standards of the evaluation process.
6. Issue value judgments on the extent of conformity or non-conformity of the reality or situation which is being evaluated with or deviation from the standards.
7. Make the necessary decisions to change, modify, improve or increase the assessment processes. [16].

The researcher assumes that in the light of the assessment results, the poor performance is identified in order to improve it, and the proper performance to support it, and the wrong performance to change it, in order to achieve a more effective performance.

Performance Assessment Methods: methods that used in the laboratory work assessment are:

1. Writing reports.
2. Laboratory tests.
3. Observation.
4. Assessment through observation. [17].

This work adopted the fourth type (assessment through observation) to assess student performance in the current research.

**NSTA standards:** The study assumes that preservice teacher performance assessment through NSTA standards may play an important role in improving the quality of science education. In this regard, the flexibility of education in any country has made the response to the idea of standards natural, and such standards may prove effective in developing and diagnosing preservice teachers' performance through the observation form prepared by the researcher. The following is the explanation of the content knowledge standard (one of the 2012 NSTA standards) for science teachers' preparation [18]:

**Content Knowledge Standard:** It means that utterance and knowledgeability of the content are the most important attributes of highly qualified teachers. To be an effective, the science teacher should have a deep foundation of factual knowledge, and should be able to understand facts and ideas in the context of the conceptual framework, and to organize knowledge in ways that facilitate its retrieval and application.

**Research Methodology:** This work adopted the descriptive approach to achieve the research objectives, which is one of the most common and widespread research methods in educational researches, it works to investigate a phenomenon of educational and psychological phenomena, as it exists in the present time, for diagnosing it, revealing its aspects and identifying the relationship among its elements[19].

**The Procedures**

1. **Research Community:** identifying the research community is one of the main tasks in the research and must be implemented by the researcher with precision and mastery. It is the group of elements or individuals

who are interested in a particular study or group of observations or measurements that combine these elements as shown in tablet[20].

**Table (1) Shows the number of research community members distributed according to basic education colleges / science department**

Ref	University	College	Department		Total
			Male	Female	
1	Babylon	Basic Education	65	84	149
2	Mustansiriya	Basic Education	34	83	117
3	Mosul	Basic Education	65	16	81
4	Missan	Basic Education	14	23	37
5	Kufa	Basic Education	-----	-----	-----
6	Anbar	Basic Education	23	5	28
7	Wasit	Basic Education	31	41	72
8	Tikrit	Basic Education	24	5	29
9	Diyala	Basic Education	18	43	61
10	Sumer	Basic Education	15	20	35
11	Muthanna	Basic Education	30	59	89
12	ThiQar	Basic Education	-----	-----	-----
13	Kirkuk	Basic Education	-----	-----	-----
14	Telafar	Basic Education	-	-----	-----

This work was limited to the basic education colleges, in which only the science department existed, their number is (10), as in the table (1). After the researcher obtained the mission facilitation letter, he could obtain data from Department of Science (which includes biology, chemistry and physics) of Basic Education College / Mustansiriya University. The current research covered (100) students, (29) male and (71) female students out of preservice teachers of the fourth stage for the academic year 2017-2018, distributed to (95) schools of Education Directorates in Karkh and Rasafa: (30) Biology, (36) Chemistry, and (34) Physics. The researcher also obtained a mission facilitation letter from Basic Education College / Babylon University addressed to the General Directorates of Education in Baghdad. The researcher went to those directorates and got the mission facilitation letter to visit schools of Baghdad Education Directorates.

2. **The Sample:** The current research requires the researcher to determine the research sample, because its determination is indispensable, and the research sample is a partial group of the research community and well represents the elements of the community, that the sample can be distributed to the whole community and make inferences about the community [21].

The research sample was randomly selected, reached (100) students distributed to the research community schools: (95) schools. On this basis, the sample of students from preservice science teachers of the fourth stage (Biology, Chemistry, and Physics) was selected. The number of

students (100) males and (71) females were selected intentionally.

3. **The Tool of the research:** since the current objective is the assessment of preservice science teachers' performance / Basic Education Colleges according to the NSTA content knowledge standard, this requires the use of literature, books and theoretical studies on performance assessment. To achieve this study objective, the 2012 content knowledge standard has been translated and then creating a note card and presented it to the teachers of teaching methods, education, psychology, measurement and assessment, as well as educational supervisors to take advantage of their views and experiences on the most important proposals that they consider appropriate to enriching questionnaire terms (indicators) of the study tool, in the light of which the performance will be evaluated by the researcher as a tool to determine the preservice teacher performance level, where they think through their experiences that they are indicators to be available in the performance according to the standard. Therefore, the researcher identified indicators of the NSTA content knowledge standard, where its words have been formulated, taking into account the following:

1. Formulation of indicators accurately and clearly.
2. Phrases correctness in measuring the indicators that have been developed to measure them.
3. The affiliation of each indicator to the standard or field from which it emanates.
4. The correctness and accuracy of syntax of expressions.

Then the researcher described the indicators derived from the standard in a behavioral form, which accurately

described the performance required of the preservice teachers. The questionnaire is estimated according to the five-dimensional Likert scale, i.e. it uses numbers for indicator: (5=always, 4=somewhat, 3=sometimes, 2=rarely, 1= never). The main purpose of these procedures was to contribute to determining the degree of content knowledge available in the preservice teachers' performance.

After the translation of the main standard as approved by the American Science Teachers Association NSTA in 2012, which was obtained from the official website of the Association, the content knowledge standard includes in its initial version (12) indicators; and after it was presented to a selection of arbitrators specialized in the field of teaching methods, educational psychology, measurement and assessment as well as educational supervisors; the number of standard indicators after adjustment became (9) indicators.

**Instrument Validity:** The researcher relied on honesty by presenting the observation card with his standards and indicators to a group of arbitrators specialized in the teaching methods of science, measurement and assessment, educational psychology and educational supervisors. He asked them to give their opinions and views on the validity of the standard and its indicators. Upon collecting questionnaires of the experts, the indicators have been adjusted and formulated. All items obtained values of Chi-square test, calculated in terms of the difference between the pro and against in the light of this standard equals to (3.84) at the level of (0.05) and freedom degree of (1). Table (2) shows this process:

**Table (2) The Chi-square value is to know the opinions of the experts in the validity of the preservice teachers' performance assessment items according**

Performance assessment standard	Indicator number	Expert number	Pro	Against	Chi-square value		Function
					Calculated	Scheduled	
Content knowledge	1/2/4/6/9/11	30	30	-----	30	3.84	Function
	3/10/12		29	1	26.13		Function
	5/7/8		20	10	3.333		Not Function

Note that the Chi-square test value is equal to 3.84 at the level of 0.05 and the freedom degree (1)

1. **Instrument Stability:** The research instrument should be stable and the instrument cannot be stable unless it yields the same results when reapply to the individuals themselves and under the same circumstances [22].

To verify the instrument stability of the current research, the researcher used the observation card which included the NSTA content knowledge standard by visiting a number of preservice teachers of the sample and observing the preservice science teachers during the lesson to know the nature of their educational performance. The researcher put appropriate mark next to each standard indicator in line with the preservice teacher performance, note that the researcher used (1,2,3,4,5). After completing the observation, he cleared the data and then extracted the stability coefficient using the Cronbach's Alpha for the grades recorded by the researcher: (0.77).

To verify the correction of research instrument stability, 10 random samples were withdrawn, and corrected by the same researcher using the Pearson correlation coefficient 14 days after the first correction reached (0.98). The correlation coefficient is good, and then the questionnaires were re-corrected by another researcher\* using Pearson correlation coefficient between the

researcher correction and the other researcher correction. The results showed that the stability coefficient was (0.97), it is a high stability coefficient[23].

2. **Instrument Application:** The instrument application to the basic research sample was made in the second semester when the students started the preservice teacher education in their schools.

3. **Statistical Methods:** Chi-square test (k2), arithmetic mean, standard deviation, t-test for two independent samples, Alpha Cronbach equation, Pearson correlation coefficient, second test of ratios for one sample.

**Showing Results :**

In order to verify the first objective in identifying the preservice science teachers' performance / Basic Education Colleges, according to the content knowledge of NSTA standards, the second test was used for one sample. Results showed differences in some T values, while there were no differences in T values in the other compared with the second tabular value of (1.98), at level (0.05) and freedom degree (99). The table (3) shows this process:

\*Ahmed Abdulsalam, the biology teaching methods/ basic education college/ Al-Mustansiriya University ?

**Table (3) the second test for a single sample:**

Performance Assessment Standard	Number	Arithmetic Mean	Standard Deviation	Median	T-Value		Function
					Calculated	Tabular	
Content knowledge	100	26.3700	4.01425	27	1.569	1.98	Not-Function

\*Note that the tabular T-value = (1.98) at (0.05) and the degree of freedom (99).

**THE RESULT:** The researcher found that the content knowledge standard is acceptable. The table above shows that the content knowledge standard has t-value, calculated (1.569). It is statistically not function because it is smaller than the tabular T-value (1.98) at (0.05) and the degree of freedom (99). This indicates that this standard is medium.

**Second Objective:**

**Table (4) the second test for two independent samples:**

Performance Assessment Standards	Sex	Number	Arithmetic Mean	Standard Deviation	T-Value		Function
					Calculated	Tabular	
Content knowledge	Female	71	27.3662	3.68875	4.196	1.98	Function for female
	Male	29	23.9310	3.77899			

\*Note that the tabular T-value = (1.98) at (0.05) and the degree of freedom (98).

**Third Objective:** the researcher dealt with the results, interpreted and discussed them according to the third objective of the study which he aims to achieve, i.e. to show strengths and weaknesses in the preservice science teachers' performance / Basic Education Colleges, according to the content knowledge standard, during

1. Differences in performance by gender (male, female).
2. T-Test for two independent samples.
3. Result / function, i.e. there are differences in this standard and in the instrument as a whole in favor of the females.

For documenting differences of statistical significance in the pre-service science teachers' performance / Basic Education Colleges, according to content knowledge standard by sex (male, female).

The researcher extracted the arithmetic mean and the standard deviation for both males and females writing them on the observation card, and by using the second test for two independent samples to determine the difference function between the male and female average, the content knowledge standard and the observation card as a whole, as shown in Table (4).

observation by the researcher while they were practicing in schools, and knowing the standard meeting percentage of each indicator of the content knowledge standard in terms of their achievement in the preservice teachers' performance, as shown in Table (5):

**Table (5)**

Ref	Content knowledge Indicators	5	4	3	2	1	Arithmetic mean	Standard Deviation
		23	29	24	15	9		
2	Science is exercised in classrooms as described in the textbook.	17	31	27	19	6	3.3400	1.1478
3	Explains the knowledge and practices of contemporary science	17	16	14	15	38	2.5900	1.5380
4	Explains important concepts, ideas and applications in the available areas and their supporting areas.	12	20	20	17	31	2.6500	1.4097
5	Explains the main concepts and sub-concepts of the study material.	9	37	6	5	43	2.6400	1.5473
6	Provides enriching information for the curriculum content appropriate to the mental levels of the student	19	21	23	27	10	3.1200	1.2814
7	Keeps pace with the scientific developments and modern educational practices that fit the textbook content	4	7	24	15	50	2.0000	1.1806
8	Develops scientific thinking skills of the students as in the textbook content	16	25	34	23	2	3.3000	1.0588
9	Uses educational innovations in the course of daily teaching to enrich the scientific material in the textbook content	17	25	31	26	1	3.3100	1.0702

The researcher adopted the alternatives mean (1.2.3.4.5), at (3), i.e. each indicator obtains arithmetic mean (3) and more, this indicator is considered as met. While the indicator, which obtains the arithmetic mean less than (3), such indicator is considered as not met; and therefore we notice that:

1. Item (1) came in the first rank because it got the highest arithmetic mean (3.4200). The second rank was Item (2) because it got arithmetic mean (3.3400).

While in the third rank was Item (8) because it got arithmetic mean (3.3000).

2. It is clear that there are (5) indicators achieved, (1.2.6.8.9) because their arithmetic means are more than (3). There are (4) indicators that are not met, they are (3.4.5.7) because their arithmetic means are less than (3).
3. It can be seen that the content knowledge achievement ratio is (56%).

**Results Interpretation:** It is clear from the table above that there are (5) indicators are met, which are (1.2.6.8.9) because their arithmetic means are more than (3). The researcher attributed this matter to the science curriculum at the elementary stage includes the facts and concepts associated with the daily life of students, and also encourages them to focus on examples inspired by the reality; in addition, employing the techniques in the field of education within the classroom. There are four indicators that are not met; they are (3.4.5.7) because their arithmetic means less than (3). The researcher attributed this matter to the need to introduce science preservice teachers within the educational training programs in order to enlighten them about modern educational developments.

**Conclusions:** The science preservice teachers concern in the content knowledge standard, The science preservice teachers are aware of modern assessment methods and The science preservice teachers focus on modern teaching methods.

#### RECOMMENDATIONS:

1. NSTA standards should be adopted to assess preservice teachers' performance.
2. Standards that are used in the assessment process should be unified.
- 3.

**Proposals:** Conduct a study similar to the current study to assess the preservice teachers' performance, according to NSTA standards in other humanities disciplines.

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