

The Psychological Thinking Level of Biology Teachers Employment of Technological Innovation According to (NSTA) Standards

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Abstract:

The research aims detecting the level of biology teachers employing technological innovations according to (NSTA) standards by building a scale. NSTA standards, which are consistent with biology teachers in measuring technological innovations. Revealing the significant differences in the level of employing technological innovations according to the variables (gender, years of service). The current research community has been identified with biology teachers in the secondary stage for the academic year (2020-2021) in Al-Muthanna Governorate, whose number is (286) teachers, and a sample consisting of (115) teachers and schools, and the variable measuring technological innovations. To achieve the objectives of the research, the researcher relied on the following: Using the descriptive approach to detect the level of employing technological innovations according to (NSTA) standards. Building a scale for employing technological innovations according to (NSTA) standards by examining the researcher with the literature and previous studies related to the subject of the research. The scale in its final form consisted of (53) five-alternative items. They were distributed among nine domains (NSTA standards) which are (content, nature of science, investigation, biological issues, teaching skills, curriculum, evaluation, professional growth, and occupational safety). The researcher applied his research tool in the form of on the day 14/2/2023 on the research sample consisting of (115) male and female teachers in the secondary stage in Al-Muthanna Governorate, which were chosen by the intentional method from which they were chosen according to the proportional method, for the academic year (2022-2023).) and after data collection and statistical processing using (SPSS). The research reached the following results: The level of employment of biology teachers at the secondary level with technological innovations according to (NSTA) standards is medium, with the total weight percentile of the scale (61.2%). All (NSTA) standards agreed with biology teachers in employing technological innovations, where the percentage weights of the standards were higher than the cut-off score (60%) set by the researcher to determine employment, except for the evaluation standard, which was less than the cut-off score with a weight percentile of (53.7%). It is not compatible with biology teachers. There were statistically significant differences in the level of employing technological innovations according to (NSTA) standards, according to the gender variable, in favor of males. Statistically significant differences appeared in the level of employing technological innovations according to (NSTA) standards, according to the variable years of service, in favor of teachers who had years of service (11 or more), as it came with the highest arithmetic mean, while teachers who had years of service from (1-5) came in last place.

Keywords: biology teachers, technological innovation, NSTA standards, psychological thinking, cognitive behavior.

Introduction:

The rapid development of scientific technology in all scientific fields has clearly affected the education sector and the extent to which modern technology is employed in the educational process. Education in general and scientific education in particular has an important responsibility, which is the preparation of human cadres capable of keeping pace with the rapid scientific and technological progress in various fields. Scientific education seeks to develop the teacher of biology, as he is the main pillar in the classroom, through preparing and training him using modern teaching methods and technological innovations that enable him to do his work.

In order for the teacher to be able to perform his mission to the fullest, and in light of this information revolution, it is necessary to take advantage of the technological innovations in teaching biology in solving the problems that they face in teaching their students. The biology teacher should be familiar with the use of technological innovations in the teaching process. The importance of the research contributes to enabling biology teachers to use technological incentives in their teaching according to (NSTA) standards.

Research problem

E-learning is a new method that strongly imposed itself on educational institutions in Iraq and the world at the present time, as a result of the outbreak of the covid-19 and the disruption of schools and universities, as it has become an important part of the entity of educational institutions and is a broad information base that contributes to opening areas of communication between students and teachers and between students. Themselves, they have contributed to trying to solve the crisis of disrupting school hours.

The use of technology in the service of education, although it exists as an idea in the minds of teachers, but it was not used sufficiently in the study plans, and this is what prompts the researcher to try to study the reality and the difficulties of employing technology in the service of education, which represents an urgent need to conduct many studies and research in this field. Based on this, the researcher was able to monitor the justifications that made him feel the problem of this research, which is that there is a significant shortcoming in the use of technological innovations in teaching and that the usual methods still dominate the use of educational technologies, and the reason for this is the lack of human cadres supervising learning or Lack of knowledge of the process of operating and maintaining the devices, or not having adequate training on them, or the teacher's fear of using them in incorrect ways, and then holding them accountable by the administration, and the teacher's lack of conviction in employing technological innovations, as well as weak urging the administration to use most of these devices and materials confined to the school stores, and in this context The researcher found that the educational means used by teachers are limited to pictures and drawings in the student's book, the blackboard and chalk, without the educational means and techniques having any significant share (Abdul Razzaq, 2018: 1712).

The research problem is the following question: What is the level of employment of biology teachers for technological innovations according to (NSTA) standards?

Research aims

- 1- The level of employment of biology teachers, technological innovations, according to NSTA standards.
- 2- Develop a list of NSTA standards that are consistent with biology teachers.
- 3- Significance of the difference in the level of employment of biology teachers for technological inducers according to NSTA standards, depending on the variable of gender and years of service.

The Research limits

The research is determined by biology teachers in the General Directorate of Education in Al-Muthanna Governorate for the academic year 2022/2023.

Theoretical background

Technological innovations:

The current era is characterized by scientific progress in all fields, which imposed a number of challenges on the educational system at different stages through the use of many technological innovations in the service of the educational process and its employment in teaching. Among the models of technological innovations that are used in daily and educational life are: the computer, Multimedia Technology , Interactive video, Internet ,Video

conference , Open Instruction ,Mastery Learning ,Computer Assisted Instruction ,Interactive Multimedia ,Hypertext Systems ,Hypermedia Systems ,Modules ,Audio Tutorial System ,Video Tutorial System ,Computer Tutorial System , Individualized Instruction, Computer Conferencing ,E-Mail , Fax mile ,Video Text ,Mobile ,Satelites. (Faroun,2019:54)

NSTA standards

These are standards set by the National Association of Science Teachers and are represented in (content, nature of science, investigation, biological issues, teaching skills, curricula, evaluation, professional development, occupational safety). (NSTA,2003 :2-32)

Search procedures and tools

The research method

The researcher adopted the descriptive research method, as an appropriate approach to studying the correlational relationships between variables in describing and analyzing the phenomena studied, because it “helps to clarify and explain the phenomenon as it exists in reality, with the intention of diagnosing it, revealing its aspects, and determining the relationships between its elements or between them and other phenomena.”

The research community

Determining the research community is one of the basic steps in educational research and requires high accuracy in determining it, as all research procedures, design of its tools and the adequacy of its results depend on it. The current research community included all the biology teachers in the General Directorate of Education in Al-Muthanna Governorate for the academic year 2022/2023, and their number reached (809) male and female teachers (286). Table (1)

Table (1) Description of the research community

| N | Place | Male | Female | Total |
|---|-------------|------|--------|-------|
| 1 | Al samawa | 44 | 71 | 115 |
| 2 | Al Rumiatha | 39 | 24 | 63 |
| 3 | Al Kudher | 25 | 17 | 42 |
| 4 | Al Warkaa | 17 | 12 | 29 |
| 5 | Al Salman | 4 | 0 | 4 |
| 6 | Al Hilal | 11 | 8 | 19 |
| 7 | Al Swayer | 8 | 7 | 15 |
| | Total | 148 | 138 | 286 |

The research sample

The sample of the research amounted to (115) male and female Biology teachers their percentage was (40%) from the community. Table (2)

Table (2) Distribution of the research sample by gender.

| Gender | No. | Percentage % |
|--------|-----|--------------|
| Male | 44 | 38% |
| Female | 71 | 62% |
| Total | 115 | 100% |

Table (3) Distribution of the study sample according to the number of years of service.

| years of service | No. | Percentage % |
|-------------------|-----|--------------|
| From 1-5 years | 21 | 18% |
| From 6-10 years | 33 | 29% |
| 11 years and over | 61 | 53% |
| Total | 115 | 100% |

From Table (3) above, we notice that more than half of the sample (53%) have more than 11 years of service, while (18%) have from one to five years.

Search tools

Technological innovations employment scale according to (NSTA) standards: The scale consisted of (53) items distributed over nine domains (content, nature of science, investigation, biological issues, teaching skills, curriculum, assessment, professional development, occupational safety), and table (4). Shows it.

Table (4) Paragraphs of the scale of employing technological innovations according to (NSTA) standards in each of the fields

| N | Domain | Number of paragraphs | Paragraphs |
|---|--------------------------|----------------------|---|
| 1 | Content | 4 | 1,2,3,4, |
| 2 | nature of science | 4 | 5,6,7,8 |
| 3 | Investigation | 5 | 9,10,11,12,13 |
| 4 | biological issues | 3 | 14,15,16 |
| 5 | teaching skills | 14 | 17,18,19,20,21,22,23,24,25,26,27,28,29,30 |
| 6 | Curriculum | 3 | 31,32,33 |
| 7 | Assessment | 10 | 34,35,36,37,38,39,40,41,42,43 |
| 8 | professional development | 7 | 44,45,46,47,48,49,50 |
| 9 | occupational safety | 3 | 51,52,53 |
| | total | 53 | |

Presentation and interpretation of results :

1- To reveal the level of employment of technological innovations by biology teachers according to (NSTA) standards, a measure of employment of technological innovations according to (NSTA) standards was applied to a sample of (115) biology teachers. The weighted media and percentile weights were calculated for the items of the main scale, as the weighted media ranged from (3.38) to (2.33), and the percentile weights

ranged from (67.65) to (46.60), as the general average of the weighted median reached (3.06), with a weight percentile (61.26). It is clear from this result, that the level of employing technological innovations is moderately, according to (NSTA) standards, because it is higher than the (cut-off score) with a weighted mean (3), and weight percentile (60%), adopted by the researcher to determine the level of employing technological innovations according to the criteria (NSTA). Table (5)

Table(5)

The weighted mean, percentage weight, and level of verification of the overall scale of the level of employment of technological innovations according to (NSTA) standards

| The weighted mean | The percentage weight | The level of verification |
|-------------------|-----------------------|---------------------------|
| 3.063 | 61.26% | with a moderate degree |

2- Developing a list of (NSTA) standards that agree with biology teachers in employing technological innovations:

Weighted media and percentage weights were calculated to determine the level of employing technological innovations according to (NSTA) standards, and all standards came with an average degree of achievement. Table (6) .

Table (6) Weighted media and percentage weights were calculated to determine the level of employing technological innovations according to (NSTA) standards

| N | Domain | Weighted media | percentage weights | The level of verification |
|---|--------------------------|----------------|--------------------|---------------------------|
| 1 | Content | 3.126 | 62.52% | moderate degree |
| 2 | nature of science | 3.202 | 64.04% | = |
| 3 | Investigation | 3.214 | 64.27% | = |
| 4 | biological issues | 3.148 | 64.95% | = |
| 5 | teaching skills | 3.155 | 63.09% | = |
| 6 | Curriculum | 3.003 | 60.05% | = |
| 7 | Assessment | 2.687 | 53.73% | = |
| 8 | professional development | 3.062 | 61.24% | = |
| 9 | occupational safety | 3.130 | 62.60% | = |

3. Detecting the significance of differences in the level of employment of biology teachers for technological innovations according to NSTA standards) according to the gender variable: By testing the difference between two independent samples, it was found that the arithmetic mean value for males was (167.6364) with a standard deviation of (20.41556), and the arithmetic mean for females was (139.23) with a standard deviation of (18.31351). It was found that the calculated t-value (7.733) is greater than the tabular t-value (1.96) at the level of significance (0.05) and with a degree of freedom (113), which indicates that there are statistically significant differences in the level of employment of technological innovations according to the gender variable in favor of males and Table (7) explains it.

Table(7) Significance of the difference in the level of employing technological innovations according to (NSTA) standards, according to the gender variable

| gender | sample | Mean | Std. Deviation | degrees of freedom | The calculated t value | tabular value | 0.05 |
|--------|--------|---------|----------------|--------------------|------------------------|---------------|----------|
| Male | 44 | 167.636 | 20.4155 | 113 | 7.737 | 1.96 | function |
| Female | 71 | 139.239 | 18.3135 | | | | |

From this it is inferred that the estimation of the level of use is affected by the gender of the teacher, and the result was in favor of males. In light of the previous results, it is clear that the level of use among teachers is significantly higher than that of female teachers, as the arithmetic averages were uneven.

Detecting the significance of differences in the level of employment of biology teachers for technological innovations according to NSTA standards) according to the variable years of service: it was found that the arithmetic mean for teachers with 11 years of service or more is (164.3443) and a standard deviation (20.46695). As for teachers who have years of service from 6-10, their average score was (137.3636).) and a standard deviation of (15.08894), as for teachers who have years of service from 1-5, the arithmetic mean was (128.7619) and a standard deviation of (13.40487), and table (8) shows this.

Table (8) Significance of the difference in the level of employing technological innovations according to (NSTA) standards, according to the variable years of service

| the variable years of service | sample | mean | Std. Deviation |
|-------------------------------|--------|----------|----------------|
| From 1-5 years | 61 | 164.3443 | 21.23385 |
| From 6-10 years | 33 | 137.3636 | 21.47982 |
| 11 years and over | 21 | 128.7619 | 14.65817 |
| Total | 115 | 150.1043 | 31.01479 |

To find out if these differences are statistically significant, the researcher used the one-way analysis of variance test (ONE WAE ANOVA), and Table (9) shows that.

Table (9) shows the data of the one-way analysis of variance test (ONE WAE ANOVA) for the variable years of service for the employment scale of technological innovations

| Domain | source of variance | sum of squares | degrees of freedom | mean of squares | F value | level of significance |
|---------------------------|--------------------|----------------|--------------------|-----------------|---------|-----------------------|
| technological innovations | between groups | 27291.531 | 2 | 13645.766 | 42.43 | 0.05 |
| | within groups | 36013.216 | 112 | 321.547 | | |
| | Total | 63304.748 | 114 | | | |

The results show that there are statistically significant differences for the variable years of service and in favor of teachers who have years of service (11 or more) with arithmetic mean of (164.3443). The results are that the more years of service, the higher the level of employing technological innovations, i.e. a direct positive relationship. The reason is due to the experience in teaching for many years, the methods of using modern methods in teaching, and the method of dealing with each innovation and new.

Conclusions

1. The level of employment of biology teachers for technological innovations according to (NSTA) standards is medium, as the total weight percentage of the scale is (61.2%).
2. All (NSTA) standards agreed with biology teachers in employing technological innovations, where the percentage weights of the standards were higher than the cut-off score (60%) set by the researcher to determine employment, except for the evaluation standard, which was less than the cut-off score with a weight percentile of (53.7%). It is not compatible with biology teachers.

3. There were statistically significant differences in the level of employing technological innovations according to (NSTA) standards, according to the gender variable, in favor of males.
4. Statistically significant differences appeared in the level of employing technological innovations according to (NSTA) standards, according to the variable years of service, in favor of teachers who had years of service (11 or more), as it came with the highest arithmetic mean, while teachers who had years of service from (1-5) came in last place.

Recommendations

1. Preparing teachers in secondary schools to confirm their readiness to carry out modern teaching practices and educational trends based on technological standards using technological innovations and training them on them.
2. The need to provide the necessary infrastructure in the school environments, such as communication networks, the Internet, computers, etc., to use technological innovations in the educational process, and to provide technicians for its maintenance.
3. Providing technological educational programs that can be employed in teaching various courses in general education.
4. The need to prepare academic courses electronically to facilitate the process of presenting them to students through technological innovations.

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