



# The Degree to Which Earth and Environmental Science Teachers Practice Twenty-First-Century Skills in Jordan

**Omar Riyad Al-Qaqah<sup>1</sup>, Hussein Abdellateef Ba'arah<sup>2</sup>**

<sup>1</sup>Ph.D. Researcher in Curricula and Instruction, Ministry of Education, Jordan

<sup>2</sup>Prof. of Curricula and Instruction, Faculty of Educational Sciences, Mutah University, Jordan

Email: omar.alqaqa12@gmail.com, h\_baarah@mutah.edu.jo

**Abstract:** *The study was aimed at revealing the degree to which earth and environmental science teachers practice the skills of the twenty-first century in Jordan. The researchers used the descriptive approach. The study population consisted of all 886 teachers of earth sciences and environment in the northern region of Jordan. The sample study was selected in a simple random manner, with 201 teachers and 23% of the study population. The researchers used the 21st Century Skill identification study instrument applied to the sample study. The results of the study showed that the degree of the practice of the 21st Century Earth and Environment Science Teachers was at the intermediate level and at average (3.52). The results also showed that there were no statistically significant differences in the extent to which Earth and Environment Science Teachers practiced twenty-first-century skills in the light of their gender, scientific qualification, and experience.*

**Keywords:** *earth and environmental science; teachers; twenty-first-century skills; Jordan*

## I. Introduction

Twenty-first-century skills are among the new movements that emerged in 2002, with the aim of supporting students in careers and the university in terms of mastering both content and skills (Hassan, 2015). These skills have been advocated across disciplines through the Twenty-first Century Skills Partnership, which was established through a partnership between United States educational institutions and a range of businesses such as Microsoft Corporation and the National Education Association. This partnership has now become one of the most important leaders in the development and learning of twenty-first-century skills in the world (NSTA, 2011).

The Partnership has produced five manuals on education support systems: standards, assessments, professional development, curricula, teaching methods, and learning environments. It should be noted that these guides are not simply a support to education, but a means to a larger goal, which is to help learners develop the knowledge, psychological, and skill competencies they need to succeed in life in the twenty-first century. They also help politicians, State leaders, school leaders, and teachers to develop the skills of the twenty-first century within the education process (National Research Council, 2012). Twenty-first-century skills include collaboration, communication, digital literacy, citizenship, problem-solving, critical thinking, creativity, and productivity (Voogt & Roblin, 2012).

The term "twenty-first-century skills", according to Partnership for Twenty-First Century Skills, refers to the skill set for success and action in the twenty-first century, such as learning and innovation skills, information, media and technology culture, life and work skills, ways of thinking, working and living in connected, media-rich worlds. (Binkley et al, 2011). The Partnership for Skills 2006 (Century First Twenty) also defined it as Skills including

problem-solving, individual creativity, collaboration, innovation, use of technology instruments, adaptability, and problem-solving.

Al-Harthy introduced his to 2020 the skills that contribute to the formation of a student teacher who can adapt and keep up with the changes of the age in the 21st century. Marzano & Hevelpur (2017) define it as "the set of skills that students will need to succeed in the 21st century".

National Science Teachers Association (NSTA) prepared a map to illustrate how to integrate 21st-century skills into science teaching and curriculum, including the Earth Science and Environment Books, and the approach based thereon in the teaching of these books, which are considered one of the basic and secondary science books. The National Society of Science Teachers (Earth Science and Environment) expressed its support for 21st-century skills and the need to include them in the context of pre-university education, supporting such education through teaching and development of the best practices (Science and Environment) through the development of the Science Systems The Earth and the Environment), in their view, the skills of the twenty-first century and the quality of scientific education are mutually supportive (National Science Teachers Association, 2013)

Therefore, the skills of the twenty-first century have emerged to meet the requirements of its learners to be successful in their scientific and practical lives and to achieve comprehensive, durable, and sustainable development. In light of this, the institutions specializing in education have developed a set of frameworks to demonstrate the skills of the twenty-first century (Al-Shammari& Al-Subaie, 2020)

### **1.1 Twenty-first-century framework of the Northern Region Central Educational Laboratory**

The Educational Laboratory reached the skills of the twenty-first century by conducting a series of operations that included a review of the previous literature, the results of research analyzing the characteristics of the Internet generation, the reports on the characteristics of the labor force required in the twenty-first century, and the survey of educators. In light of this, the Northern Region Central Educational Laboratory (NCREL, 2003) classified the 21st century into four groups:

- 1- Digital Literacy Age Digital Skills: These skills are essential to life and work in the knowledge society, and are represented by the ability to use digital technology, communication instruments, and networks to access, manage, evaluate and produce information. These include basic culture, scientific culture, economic culture, visual technology and information, understanding of multiple cultures, and universal awareness.
- 2- Creative thinking skills: Thinking Invasiveness includes adaptability, self-direction, curiosity, creativity, risk tolerance, and top thinking skills.
- 3- Effective communication skills: Communication Effective includes teamwork skills, personal skills, personal, social, and civic responsibility, and interactive communication.
- 4- High Productivity Skills: Productivity High includes priority-setting, planning and managing results, and the efficient use of real-world technology instruments for communication, collaboration, problem-solving, and task accomplishment.

The Partnership for Twenty-First Century Skills launched a report that illustrates these skills and curricula, teaching methods, evaluation methods, professional development of teachers, and learning environments for students to acquire twenty-first-century skills.

Terling and Fadil (2013) divided these groups into:

- 1- Learning and Innovation Skills Innovation and Learning: This set of skills consists of creativity and innovation, critical thinking and problem solving, collaboration and communication.
- 2- Digital Culture, Information, Media and Technology, Digital Media and Media, Information Skills Culture: The collection consists of information culture skills on access to and use of information, media culture on media, interaction and use, and technological culture skills that include technical skills.
- 3- Life and Career Skills: Skills Career and Life. This group consists of the following skills: flexibility and adaptability, initiative and self-direction, social skills, productivity and accountability, leadership, and responsibility.

### **1.2 Assessment and Teaching of 21st Century Skills (ATC21st)**

The Twenty-first Century Skills Assessment and Education Project defined these skills in four categories (Abu Rashid, 2020):

- Category I: Ways of thinking include: innovation and creativity, critical thinking and problem solving, and learning how to learn / beyond knowledge (knowledge about cognitive processes).
- Category II: Instruments for working, including Information literacy, and ICT literacy.
- Category III: Methods of working (Ways of working) include: Communication and collaboration (working in a team).
- Category IV: Ways of living in the world include: local and global citizenship, life and function, social and personal responsibility and includes cultural and civic awareness.

### **1.3 Skills for a 21st-century teacher**

- Skills and ability to employ modern teaching strategies appropriate to the knowledge content of the material
- Thinking skills can be developed and deployed in students to enable them to produce knowledge, not just receive knowledge. Some of these skills (basic thinking skills, critical thinking skills, problem-solving skills, and creative thinking skills) are available.
- The skills of using modern teaching techniques and employing technology in accomplishing study goals, such as using static and animated presentations (filmmaking), audio and video from YouTube and others
- Skills to select the appropriate assessment criteria. It is necessary to work on the use of new technology in the field of assessments, such as using charts, promotion schedules, and others
- Class management skills and creating the appropriate classroom environment through which to achieve study goals (Momani, 2018; Shalaby, 2014).

Al-Naqa & Eid (2012) emphasize the role of moral, cultural, professional, human, and social teachers, as it reflects positively on the reform and development of society. The features of the twenty-first-century teacher include precision at work, punctuality, efficiency, and openness of mind, which includes habits and skills of scientific thinking that are conscious, critical, and appropriately controlled, together with fun and confidence, tact in speaking and dealing, self-confidence, objectivity in self-correction and in evaluating the work of students and dealing with and respecting others (Zamel, 2020)

Another feature of the 21st century's teacher is: A product, keeping pace with modern technology, globally open, and capable of using smart devices, blogging, digital orientation, collaboration, networking, project-based learning, innovation, and lifelong learning (Palmer, 2015)

Al-Harbi&Algebra (2016) conducted a study aimed to identify the level of awareness among elementary science teachers of the skills of 21st-century learners in Saudi Arabia. The survey was used as a study instrument and applied to (54) teachers in Al-Ras area. The results showed that the level of awareness of elementary science teachers of the skills of the 21st-century learners was high, while their level of awareness of thinking skills was low. The results also showed that there were no significant differences attributable to experience in teaching.

In a related context, the study of Aslan (2016) aimed to survey the views of pre-service science teachers on the impact of learning through effective teaching in the acquisition of students' skills in the 21st century in Turkey. The study sample consisted of 33 male and female pre-service teachers who were subjected to a two-year chemistry learning experience. Organized interviews and performance records analysis was used to collect study data. The results showed the effectiveness of this method in acquiring the learners' skills of the 21st century in science education.

Al-Hotaibi's study (2018) sought to evaluate the teaching performance of middle-level science teachers in light of the skills of the twenty-first century in Saudi Arabia. The study was comprised of 53 middle-level science teachers, and the study's instrument was to identify the skills of twenty-first-century science teachers. The results showed that the reality of science education did not help to apply the skills of the twenty-first century. The study emphasized the need to work to improve the performance of science teachers at the intermediate level in line with the skills of the twenty-first century.

Al-Hanood's Study (2021) aims to reveal the percentage of Earth and Environment Science books in Jordan incorporating the skills of digital culture for the twenty-first century and to understand the degree of understanding and practice of science teachers in Jordan. The study sample for the first community consisted of the content of the Earth and Environment Sciences books for the ninth and tenth grades, the main parts being parts one and two, while the study sample for the second community consisted of all the 78 science teachers in the Education Directorate of the Northwest Desert district of Mafraq governorate. The results indicated that the degree of science teachers practicing digital culture skills and their sub skills was average, with the exception of the degree of practicing media culture skills, and the results showed that there were no statistically significant differences in the degree of science teachers practicing digital culture skills as a whole and the skill of media culture, attributable to the gender variable, and there are statistical differences in the degree of practicing the skills of information and communications culture, due to the unfavorable nature of the gender differences, and the difference in the level of their statistical practices like the changes in educational qualification and experience.

#### **1.4 Study Problem and Questions**

In their work in the educational field, the researchers noted that many students do not possess many skills, such as high-level thinking skills, technology recruitment, communication, and problem-solving. This is confirmed by the National Assessment and the International Study of Mathematics and Science (TIMSS), which referred to the Kingdom's results in the 2019 TIMSS test in the field of science. The average performance of students was 402 points. The Kingdom was ranked 53 out of 58 countries that participated in this test, and 13 out of 14 G-20 countries that participated in this test. This indicates the low level of students in the international test for science (2002), which reflects the skills of the Ministry of Education, as well as a number of thinking skills, which are based on thinking skills the extent to which these skills are included in the science curriculum

The study is also the result of recommendations from studies such as the study of Khawaldeh (2022), and the study of Al-Hanood (2021), which called for further studies on the skills of the twenty-first century. In the light of the previous data, and in view of the scarcity of studies on the curricula of the earth sciences and the environment, especially in the light of the contents of the skills of the twenty-first century, this study examines the degree of the practice of the Earth and environment teachers of the twenty-first-century skills in Jordan. The problem of the study can be determined by answering the following questions:

- 1- What is the degree to which earth science and environmental teachers practice the skills of the 21st century in Jordan?
- 2- Are there statistically significant differences at the significance level ( $0.05=\alpha$ ) in the degree to which Earth and environmental science teachers practice twenty-first-century skills in light of their gender, scientific qualification, and experience?

### **1.5 Study Objectives**

- 1- Knowledge of the degree to which Earth and environmental science teachers practice the skills of the twenty-first century in Jordan.
- 2- Disclose statistically significant differences at the significance level ( $0.05=\alpha$ ) in the degree to which Earth and environmental science teachers practice twenty-first-century skills in light of their gender, scientific qualification, and experience.

### **1.6 Significance of the Study**

It provides a clear picture of the reality of the practice of earth and environment science teachers of the twenty-first-century skills, which benefit educational leaders by conducting professional development programs that help, develop professional and teaching skills in the light of the skills of the twenty-first century. It is also one of the first studies that attempt to determine the degree of the practice of earth and environment science teachers of the skills of the twenty-first century in Jordan.

### **1.7 Conceptual and Procedural Definitions**

Twenty-first-century skills: A collection of skills and abilities that students need for learning, innovation, life, work, and optimal use of information, media, and technology, which are expected to be included in the Handbook on Earth Science and Environment, for success in the 21st century, and which will be analyzed, using an analytical instrument that the researcher will develop specifically for this study.

Degree of practice: The practical practices of geosciences and environmental teachers of the skills of the twenty-first century. These are measured procedurally by the average score that geoscientific teachers estimate for themselves of the skills of the twenty-first century, represented by the questionnaire items.

Earth science and environment teachers: Teachers of earth sciences and the environment who attend the ninth, tenth, first secondary, and second secondary education classes in the public schools of the Ministry of Education in Jordan for the academic year (2021/2022).

### **1.8 Study Limitation**

This study was limited to the degree of the practice of teachers of Earth sciences and the environment in the 21st century in Government schools of the Northern Region Directorates of Education in the academic year 2021-2022.

## II. Research Method

### 2.1 Study Approach

The descriptive method was used to fit the study objectives.

### 2.2 Study Population

The school community was represented in all 886 teachers of Earth and environmental sciences in the 9th and 10th grades as well as 1st and 2nd scientific secondary grades of the Ministry of Education of the Northern Region of Jordan for the scholastic year (2012/2022).

### 2.3 Study Sample

The study sample was randomly selected from teachers of Earth sciences and environment for the basic and secondary levels (ninth, tenth, first scientific secondary, and second scientific secondary). The sample consisted of (201) teachers of Earth sciences and environment in Jordan, representing (0.23) of the study community.

### 2.4 Study Instrument

The researchers designed a data-collection questionnaire designed to reveal the degree to which Earth and environmental science teachers are practicing the skills of the twenty-first century from their point of view in Jordan, after reference to previous studies and research. The initial questionnaire consisted of 54 items, including (4) areas, which were answered through a five-point scale: (very large, very high, very small, very small, average), and the corresponding degrees for these alternatives are (5, 4, 3, 2, 1) respectively.

### 2.5 Reliability

The questionnaire was presented to a group of arbitrators with experience and competence, with a view to verifying its validity. They were asked to give their opinion and observations on the items of the questionnaire, the extent to which they met the objectives of the study, the extent to which each item of the questionnaire belonged to the dimension to which it belonged, and to add, delete or modify what they deemed appropriate. Their proposals and observations were taken into account and the required modifications were made. The questionnaire was finalized in 45 items containing four areas.

### 2.6 Validity

The validity, domains, and overall degree of the questionnaire were verified using the Cronbach alpha coefficient, and table (1) shows this.

**Table 1.** Reliability coefficients for the fields of the questionnaire and its total degree

<b>Coefficient</b>	<b>Domain</b>
0.83	1- Thinking, innovation, problem solving and self-learning skills
0.80	2- Communication, cooperation and teamwork skills
0.92	3- Digital culture and technology skills
0.89	4- Career, life and leadership skills
<b>0.88</b>	<b>Total</b>

Through the values of the reliability coefficients referred to in Table (1), it is clear that the questionnaire as a whole and its fields enjoy a high degree of stability, and these values are good and acceptable for the purposes of this study.

## 2.7 Study Procedures

To achieve the objectives of the study, the following procedures were followed:

- 1- Referring to the previous educational literature, and extrapolating many studies and benefiting from them in building the study instrument.
- 2- The study instrument was prepared by the researchers, represented by a questionnaire that aims to reveal the degree to which earth and environmental science teachers practice the skills of the twenty-first century from their point of view in Jordan.
- 3- The questionnaire was applied to an exploratory group of teachers of earth and environmental sciences, to ensure its validity and reliability, and to ensure the validity of its paragraphs in achieving the objectives of the study, and the percentage of reliability was good and acceptable for the purposes of this study.
- 4- The questionnaire was applied electronically to the study population of earth and environmental sciences teachers in Jordan, where (201) male and female teachers responded to the questionnaire.
- 5- Unloading the data, monitoring its results, and performing the appropriate statistical analyzes using (SPSS), to reach and discuss the results of the study.
- 6- The degree to which earth and environmental science teachers practice the skills of the twenty-first century from their point of view in Jordan was determined using the following equation:
  - (the highest value - the minimum value) ÷ number of levels = range for each level
  - $(5-1) \div 3 = 1.33$  range, so the levels are:
    - From (1-2.33) low
    - From (2.34-3.67) medium
    - From (3.68-5) high

## 2.8 Statistical Forms

Statistical treatments were used using SPSS software as follows:

- 1- To answer the first question, means, standard deviations, and ranks were used.
- 2- To answer the second question, the triple analysis of variance test was used.

## III. Results and Discussion

### 3.1 The first study question: “What is the degree to which earth and environmental science teachers practice the skills of the twenty-first century in Jordan?”

To answer this question, the arithmetic averages and standard deviations were calculated for the fields of questionnaire and the total level, and Table (2) illustrates this.

**Table 2.** Means and standard deviations of the domains

Std. Deviation	Mean	Domain
0.364	3.70	1
0.403	3.56	2
0.488	3.35	3
0.451	3.45	4
<b>0.362</b>	<b>3.52</b>	<b>Total</b>

Table (2) shows that the mean of the total score for the degree to which earth and environmental science teachers' practice the skills of the twenty-first century in Jordan came at the average level, as the arithmetic mean reached (3.52), and the fields of this questionnaire were in the high and medium levels. Mean, standard deviations, and ranks were also

calculated for the paragraphs of the first field, which represents thinking skills, innovation, problem solving and self-learning, and Table (3) illustrates this.

**Table 3.** Means, standard deviations, and ranks of the first domain items

Level	Rank	S.D	Mean	Item
High	1	0.649	4.17	2
High	2	0.603	4.10	1
High	3	0.649	4.09	8
High	4	0.685	3.98	11
High	5	0.687	3.95	4
High	6	0.640	3.93	9
High	7	0.676	3.89	10
High	8	0.734	3.77	3
Medium	9	1.043	2.73	7
High	10	0.885	3.72	6
Medium	11	0.695	2.41	5
<b>High</b>		<b>0.364</b>	<b>3.70</b>	<b>Total</b>

Table (3) shows that the first domain, which represents “thinking skills, innovation, problem solving and self-learning” obtained an mean(3.70) at a high level, and it was also found that all the domain’s paragraphs came at a high level except for paragraph (5) and paragraph (9), which came at a high level. Mean, standard deviations, and ranks were also calculated for the paragraphs of the second field, which represents communication, cooperation and teamwork skills, and Table (4) illustrates this.

**Table 4.** Mean, standard deviations, and ranks of the second domain

Level	Rank	S.D	Mean	Item
High	1	0.61644	4.00	16
High	2	0.70340	3.98	17
High	3	0.76278	3.78	12
High	4	0.70376	3.75	13
High	5	0.68702	3.72	15
Medium	6	0.93260	3.39	14
Medium	7	1.07352	3.36	18
Medium	8	0.90471	2.55	19
<b>Medium</b>		<b>0.40366</b>	<b>3.56</b>	<b>Total</b>

Table (4) shows that the second domain, which represents communication, cooperation and teamwork skills, obtained a mean (3.56) and an average level. The rest of the paragraphs in this area came at a high level. The arithmetic averages, standard deviations, and ranks were also calculated for the paragraphs of the third field, which represents digital culture and technology, and Table (5) illustrates this.

**Table 5.** Mean, standard deviations, and ranks of the third domain

Level	Rank	S.D	Mean	Item
High	1	0.74437	3.81	30
High	2	0.84624	3.79	29
High	3	0.73305	3.77	21



High	4	0.86456	3.73	24
Medium	5	0.88377	3.64	28
Medium	6	0.98104	3.63	25
Medium	6	0.87888	3.63	26
Medium	8	0.77934	3.56	23
Medium	9	0.99033	3.47	27
Medium	10	0.92239	2.60	22
Low	11	0.97692	2.30	31
Low	12	0.89795	2.28	20
<b>Medium</b>		<b>0.48800</b>	<b>3.35</b>	<b>Total</b>

Table (5) shows that the third domain, which represents the skills of digital culture and technology, obtained an mean of (3.35) at a medium level, and paragraphs (20) and (31) came at the low level, and paragraphs (22), (23), (25), (26), (27) and (28) at the medium level, and paragraphs (21), (24), (29), and (30) at the high level.

Means, standard deviations, and ranks were also calculated for the paragraphs of the fourth dimension, which represents the skills of profession, life and leadership, and table (6) shows this.

**Table 6.** Means, standard deviations, and ranks of the fourth domain

Level	Rank	S.D	Mean	Item
High	1	0.67823	4.00	42
High	2	0.80298	3.98	44
High	3	0.82326	3.82	32
High	4	0.66471	3.78	39
High	5	0.76161	3.76	43
High	6	0.80391	3.68	40
Medium	7	0.77780	3.66	36
Medium	8	0.86493	3.65	41
Medium	9	0.72873	3.64	38
Medium	10	0.86070	3.60	35
Medium	11	1.07036	2.88	33
Medium	12	1.11237	2.77	34
Medium	13	0.97184	2.58	45
Medium	14	1.06360	2.50	37
<b>Medium</b>		<b>0.45143</b>	<b>3.45</b>	<b>Total</b>

Table (6) shows that the fourth domain, which represents profession, life and leadership skills, obtained a mean of (3.45) at an average level, and all the paragraphs of this field were at the average level, except for paragraphs (32), (39), (40), (42), (43) and (44) at the high level.

**3.2 The second study question: "Are there statistically significant differences at the significance level ( $\alpha = 0.05$ ) in the degree to which earth and environmental science teachers practice the skills of the twenty-first century in the light of gender, academic qualification, and experience?"**

This question was answered by calculating the arithmetic averages and standard deviations of the practice of earth and environmental science teachers for the skills of the twenty-first century in Jordan in the light of gender, academic qualification, and experience, and table (7) shows this.

**Table 7.** Mean and standard deviations of the degree to which earth and environmental science teachers practice the skills of the twenty-first century in Jordan in the light of gender, academic qualification, and experience

S.D	Mean	No.	Level	Variable
0.31	3.51	61	Male	Sex
0.38	3.52	140	Female	
0.35	3.49	133	Bachelor	Qualification
0.39	3.58	68	Postgraduate	
0.29	3.52	27	less than 5 years	Experience
0.33	3.45	88	5 to 10 years	
0.40	3.59	86	11 years and over	

Table (7) indicates that there are apparent differences in the arithmetic averages, and to find out the significance of these differences, a three-way analysis of variance was used, to reveal the presence of differences in the degree to which earth and environmental science teachers practice the skills of the twenty-first century in Jordan in the light of gender, their qualifications, and their experience. Table (8) illustrates this.

**Table 8.** The results of the triple analysis of variance test to reveal the presence of differences in the degree to which teachers of earth and environmental sciences practice the skills of the twenty-first century in Jordan in the light of gender, their academic qualifications, and their experience

sig.	F Value	Squares Mean	df	Sum of squares	Contrast source
0.937	0.006	0.001	1	0.001	Sex
0.225	1.479	0.193	1	0.193	Qualification
0.171	1.887	0.246	1	0.246	Experience
		0.130	197	25.691	The error
			<b>200</b>	<b>26.274</b>	<b>Total</b>

Table (8) indicates that there are no statistically significant differences between groups in the arithmetic averages of the degree to which earth and environmental science teachers practice the skills of the twenty-first century in Jordan in the light of gender, academic qualification, and experience.

### 3.3 DISCUSSION

By reviewing the above, the results showed that the degree to which earth and environmental science teachers practice the skills of the twenty-first century in Jordan came at the average level, and all fields were at the intermediate level except for the first field, which came at the high level. The five-year learning emanating from the constructivist theory, which accelerates the student's main focus in learning and provides him with the greatest opportunities in thinking skills, problem solving and investigation.

The researchers attribute these results to the fact that all teachers of earth and environmental sciences, regardless of their gender, experience and qualifications, are exposed to the same educational situations and use the same materials and instruments necessary for learning. Also, the books of earth and environmental sciences are unified in their topics in all governorates, on the other hand, they are graduates of the same universities and live in similar social environments, and this in turn gives a similar and convergent opinion on the degree to which earth and environmental science teachers practice the skills of the twenty-first century.

#### IV. Conclusion

In light of the results, the researchers recommend the following:

1. The necessity of including the skills of the twenty-first century in the professional development programs for teachers.
2. Holding training workshops aimed at guiding science teachers in general and earth sciences in particular towards the importance of twenty-first century skills and increasing their practice of them.
3. Conducting more studies that deal with the degree to which teachers practice the skills of the twenty-first century in other subjects and at different stages.

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