The Integration of 21st-Century Skills in Grade Eight Mathematics Curriculum

Nouf Ali Al Moray[1,*]

[1]Bahrain Teacher College, University of Bahrain, Bahrain

*Correspondence: Bahrain Teacher College, University of Bahrain, Bahrain. E-mail: nalmoray@uob.edu.bh

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Abstract

The study measured the extent of the implementation of twenty-first-century skills in grade eight math curriculum in public schools in the Kingdom of Bahrain, and it included all Cycle Three Mathematics Books (or curriculum) for the academic year (2022-2023). The researcher chose grade eight mathematics books in the first and second semesters as a sample for her study; furthermore, the research was conducted using the descriptive-analytical method to analyze the contents of the books using a content-analysis card.

The results showed a very high percentage (92.20%) of twenty-first-century skills integration in eighth-grade math books; as a result, the percentage of technical literacy was (14.5%), and the rate of local and global citizenship skills was the lowest (7.6%). In addition, the results showed close ratios between critical thinking, creativity and problem-solving, leadership, and decision-making (13.1% – 13.7%).

The math curriculum directs learners to access information through digital technologies and includes different mathematical problems in which digital technologies are used to achieve solutions with the highest percentage (25%-23.6%). However, it was immediately apparent that the math curriculum content failed to motivate learners to develop their skills concerning environmental sustainability (7.8%) and negotiation skills (7.9%). Overall, the literature showed that the widespread opportunity for 21st-century skills in the mathematics curriculum impacts students' abilities to obtain high grades in the TIMSS exams. This suggests that integrating science, technology, engineering, and mathematics education into mathematics curricula can provide convenience for students to evolve 21st-century skills in a consequential and effective way.

Keywords: twenty-first-century skills, content analysis, math curriculum

1. Introduction

1.1 Introduce the Problem

Janus Utzon had the creativity to imagine the Sydney Opera House; it was just an idea in a designer's mind about several algorithms and mathematical formulas. The designer had critical thinking skills to address it, but his vision had to be applied to reality. This is why he relied on a work team characterized by good communication, decision-making, and problem-solving skills. Utzon built the best design in terms of construction and had the best audio technology for listening to operas; these skills are embedded in the most famous and distinguished buildings of the 20th century, making them a legacy on UNESCO World Heritage Site.

According to the 2015 World Economic Forum, 21st-century skills are beneficial for students to face complex challenges and changing environments in school, their homes, and their future workplaces. However, Current courses primarily focus on cognitive aspects and must sufficiently equip students with these high-level thinking and skills, necessitating integrating 21st-century skills into the curriculum (Shalaby, 2014; Rashid, 2017). This global urgency further underscores the importance of our research.

The Third Cycle in the education system, a pivotal phase in a student's life, is a foundation for their personality development and preparation to become active, positive contributors to society, Hence the importance of providing students with 21st century skills that assist them in tackle real-world problems as responsible citizens in the modern era (Kivunja, 2014; Ananiadou & Claro, 2009), this integration is not just a necessity but a key determinant of their

future success, underscoring the urgency and importance of our mission.

Based on a review of the international monitoring of learning achievement through TIMSS(Trends in International Mathematics and Science Study), PIRLS(Progress in International Reading Literacy Study), and PISA(Program for International Student Assessment), it was essential to stress the importance of including the 21C skills, leadership, decision-making, critical thinking, creativity, problem-solving, communication, and teamwork in the mathematics curriculum at various educational levels. The results of the TIMSS scale conducted across Bahrain show that the mathematics students′ average point score in 2019 was 481 (1.7) and that the average educational clarity scale in mathematics classes was 10.2 (0.07) based on student reports. Bahrain's participation in the TIMSS assessments has achieved satisfactory results in mathematics and science, which leads the researcher to wonder how this relates to the degree to which the skills of the 21st century is included in the eighth-grade math curriculum.

Educational content provides students explores skills necessary to navigate and thrive in today's world (Teo, 2019), So there have been many advocates to redesign the curriculum with an emphasis on understanding, teaching, questioning, and enhancing 21st-century skills(Bialik et al., 2015), This highlights the importance of current research aimed at analyzing the content of eighth-grade mathematics books according to 21st-century skills approved by Bahrain's Ministry of Education.

1.2 Describe Relevant Scholarship

The 21st century has become increasingly important in the modern education system because it requires the development of new skills in students, such as critical thinking, problem-solving, creativity, communication, cooperation, teamwork, decision-making, and leadership (Hernandez-Fernandez, 2022).

Therefore, the curriculum needed to keep pace with developments in the twenty-first century by providing educational subjects improving 21st-century skills, and that is what Mıhladız and Açık (2021) emphasized: "The curricula and education have the most significant effects on earning the 21st-century skills."

This raises the crucial question of whether the current curriculum equips teachers with the necessary tools to foster students' 21st-century skills. A prime example is the math curriculum, which is not just a subject but a gateway to professional practice and future job skills (Ball et al., 2008). This underscores the pivotal role of mathematics in nurturing 21st-century skills, necessitating teachers to instill a positive attitude towards the subject in students (Al-Mutawah & Fateel, 2018). Nevertheless, many prospective STEM graduates are discouraged from pursuing these fields and careers that would be personally fulfilling and beneficial to society. Current mathematics instruction does not motivate or prepare students to pursue their studies. (Beswick & Fraser, 2019, 955)

However, Whitney-Smith et al. (2022) that only a few STEM teachers regularly provide integrated 21st-century skills across mathematical curricula and learning opportunities in their teaching programs. However, the findings of the study of (Steehle & perton, 2019) indicate that secondary science and technology schools provide environments that support the development of 21st-century skills. However, more could be done to develop teachers' and professional skills to improve the teaching of high levels of skills. The previous subjects, science, and technology provided tools to support communication and thinking, which led to knowledge-building and problem-solving in the real world; this highlighted the importance of integrating science, technology, and engineering education into mathematics curricula to promote the development of these skills.

Digital technology has also emerged as a prominent tool for enhancing 21st century skills century Skills in mathematics curricula. (Niemi et al., 2018) DST (digital storytelling) encourages students to apply new technology in their learning and supports literacy development in mathematics and skills competencies in the twenty-first century. DST styles direct students towards active collaborative learning; students learn how to work in groups to produce new ideas and learn about mathematics and how mathematics is linked to everyday life. As the skills of 21st century skills shift to a greater focus in education, it is crucial to meet the needs of today's students by introducing them to a new phase of technology. The results of this study (Cheng et al., 2010) indicate that students who played an educational video game showed all the expected 21st-century Skills while submerging in the integrated scientific content.

Overall, the literature suggests that students are developing 21st century skills through various strategies, including promoting positive attitudes toward mathematics, integrating digital technology, and providing comprehensive curriculum frameworks that emphasize the development of these skills. By providing students with these skills, they will be better prepared to overcome the complexities of the twenty-first century.

1.3 State Hypotheses and Their Correspondence to Research Design

The study aims to:

3-1- implement the 21st-century skills that should be included in grade eight mathematics curriculum in Kingdom of Bahrain.

3-2- identify the extent to which the 21st-century skills are included in grade eight mathematics curriculum in Kingdom of Bahrain.

2. *Method*

2.1 Research Design

This study investigated the 21st-Century Skills in the Grade Eight Mathematics Curriculum; in this sense, this is content analysis; the researcher systematically collects data from a set of math textbooks and focuses on quantitative (counting for required skills and measuring by Calculating frequency and percentage).

2.2 Participants

The participants of the study consisted of all cycle 3 mathematics curriculum for the academic year (2022-2023), and this sample was conducted through the grade eight mathematics curriculum during the two semesters. The researcher chose grade eight specifically due to the TIMSS exam students take in this stage.

2.3 Data Collection Tool and Process

The researcher initially prepared a study tool, including the 21st-century skills (8 skills) and the sub-skills (70).

2.4 Sampling Procedures

The research tool was reviewed by academic members who are specialized in curriculum and teaching methods to ensure its effectiveness. In the final form, the tool includes 58 sub-skills under the main eight skills, as shown in Table 1.

Table 1. The Final Form of a Search Tool

Key skills	Number of sub-skills
Leadership and decision-making	6
Communication and teamwork	9
Creativity and problem-solving	4
Critical thinking	8
Entrepreneurship and initiative	7
Technological literacy	10
language empowerment	6
Local and Global Citizenship	6
Total	56

The researcher wanted to ensure the stability of the analysis, so she applied the research tool by calculating the total frequencies for each category. After three weeks, the researcher repeated the analysis, and the extent of 21C skills implementation reached (0.85), which is a statistical degree that we can trust for use in the study.

2.5 Research Design

Specify the research design in the method section:

Were subjects placed into conditions that were manipulated, or were they observed naturalistically? If multiple conditions were created, how were participants assigned to conditions, through random assignment or some other selection mechanism? Was the study conducted as a between-subjects or a within-subject design?

1- The content of this study is purely about scientific analysis except for the cover, introduction, and indexes.

2- Unit of Analysis: The idea analysis was chosen due to its relevance to the nature and objectives of the study according to the following Table 2.

Table 2. Results of the Eighth-Grade Math Curriculum Analysis

Mathematics book for eight grades	Total ideas
The first semester	235
The second semester	261
The total	496

3- The teacher's guide was not included in the analysis process.

4- Judgment controls the extent to which the skills of 21st-Century Skills are included in the eighth-grade mathematics curriculum, according to the following Table 3.

Table 3. Judgment Controls the Extent to Which the Skills of the Twenty-First Century

Percentages	Extent of embedding
90 % -100 %	Very large
70 % - 90 %	Large
50 % -70 %	Medium
30% 50 %	Low
30 % -10%	Very low
Zero	Zero

3. Results

3.1 Statistics and Data Analysis

3.1.1 Implementation of the 21st-century skills that should be included in eighth-grade mathematics curriculum in Kingdom of Bahrain

The researcher designed a content analysis card consisting of eight 21st-Century Skills, divided into 56 sub-skills, based on an analysis of mathematics competencies for the eighth grade in Kingdom of Bahrain, according to the following table (1).

3.1.2 What extent are 21st-Century Skills included in the content of the eighth-grade mathematics curriculum in Kingdom of Bahrain?

The eight-grade math book was analyzed using the analysis card and calculating the frequencies and percentages of the 21st-century skills and sub-skills, according to the following table (4).

Table 4. Results of the Analysis of Eighth-Grade Mathematics Curriculum

Mathematics book for eighth grade	First semester	Percent age	Second semester	Percent age	Total	Percent age
Critical thinking	30	%12.7	35	13.4%	65	13.1%
Communication and teamwork	31	%13.1	32	12.2%	63	12.7%
Creativity and problem-solving	31	%13.1	36	13.7%	67	13.5%
Leadership and decision-making	31	%13.1	37	14.17%	68	13.7%
Local and Global Citizenship	18	%7.6	20	7.6%	38	7.6|%
Entrepreneurship and initiative	31	%13.1	30	11.4%	61	12.2%
Technological literacy	34	%14.4	38	14.5%	72	14.5%
language empowerment	29	%12.3	33	12.6%	62	12.5%
Total	*235*		261		496	92.20%

Table 4 indicates that the percentage of 21st-century skills included in the eighth-grade mathematics curriculum (92.20%) is very high. The percentage of technical literacy is the highest (14.5%), and that of local and global citizenship skills is the lowest (7.6%). The results show close ratios between critical thinking, creativity, problem-solving, leadership, and decision-making (13.1% – 13.7%).

Critical Thinking skills:

Table 5. Results of Analyzing the Implementation of Implementing Critical Thinking Skills

Sub skills	First semester	Percent age	Second semester	Percent age	Total	Percent age
Analyzing alternatives and views incorporated into mathematical knowledge.	3	10%	4	11.4%	7	10.7%
Developing the ability to interpret mathematical data and information	3	10%	5	14.2%	8	12.3%
encouraging the building and expansion of ideas	4	13.3%	5	14.2%	9	13.8%
Mathematical problems that stimulate learners to ask questions themselves	2	6.6%	4	11.4%	6	9.2%
Providing opportunities to solve mathematical problems individually	7	23.3%	5	14.2%	12	18.4%
Encouraging the evaluation of alternative viewpoints	4	13.3%	6	17.1%	10	15.3%
Providing different types of thinking (induction, deduction)	7	23.3%	6	17.1%	13	20%
Total	30		35		65	13.1%

It is clear from Table (5) that the percentage of critical thinking skills in the eighth-grade mathematics curriculum was (13.1%) with the highest percentage (20%) of different types of thinking (induction, deduction) and the lowest percentage (9.2%) of mathematical problems that stimulate learners to ask questions themselves.

This result may be attributed to the fact that mathematics books for the eighth grade include many educational situations that motivate students to use different types of thinking to reach the appropriate solution.

Communication and Teamwork:

Table 6. Results of Analyzing the Implementation of Communication and Teamwork

Sub skills	First semester	%	Second semester	%	Total	%
encouraging the acceptance of different points of view	2	6.4	3	9.3	5	7.9
Encouraging the verbal expression of mathematical ideas through mathematics situations	6	19.3	5	15.6	11	17.4
Encouraging the written expression of mathematical ideas through mathematics situations	6	19.3	7	12.8	13	20.6
Getting the less benefits from the mathematical content that might be published in media.	2	6.4	3	9.3	5	7.9
Encouraging teamwork and collaboration by presenting different activities	4	12.9	3	9.3	7	11.1
Developing the skills of negotiation through many mathematical situations	1	3.2	-	-	1	1.5
Enhancing the research skills by accessing information with both time and resource efficiency	3	9.6	3	9.3	6	9.5
Enhancing the skills of using multiple tools and media in different mathematics situations	4	12.9	5	15.6	9	14.2
Encouraging appreciation of the individual contributions of all team members	3	9.6	4	12.5	7	11.1
Total	31		32		63	13.4%

Table (6) shows that 13.4% of communications and teamwork skills are included in the eighth-grade mathematics textbooks, 20.6% are the highest, and 1.5% are the lowest. The content encourages the written expression of

mathematical ideas through mathematical situations, but it needs to be more focused on developing the skills of negotiation through many mathematical situations.

The result can be explained by the fact that the mathematics book asks the student to write the expected solution to mathematical problems, which falls under written communication skills. In contrast, negotiation skills depend on verbal and nonverbal skills.

Creativity and problem-solving:

Table 7. Results of Analyzing the Implementation of Creativity and Problem-Solving

Sub skills	First semester	Percentage	Second semester	Percentage	Total	Percentage
Motivating learners to explore mathematical topics and develop their own problems	8	25.8%	9	25%	17	25.3%
Presenting tasks that are open-ended, multiple-solution, curiosity-stimulating, or reality-related.	10	32.2%	11	30.5%	21	31.3%
Developing the skills of understanding unfamiliar interpretations of geometric figures and mathematical data	7	22.5%	8	22.2%	15	22.3%
Encouraging the development of trying multiple solutions to the same problem	6	19.3%	8	22.2%	14	20.8%
Total	31	13.1%	36	13.7%	67	13.5%

Table (7) shows that in the eighth-grade mathematics curriculum, the percentage of creativity and problem-solving skills is 3.5%; the highest percentage is 31.3%, so the content presents open-ended, curiosity-stimulating, or reality-related tasks. The lowest percentage is 20.8%, which means that the content needed to be more encouraging in developing multiple solutions to the same problem.

This conclusion is a testament to mathematics' s unique role as a mediator of creativity. It presents open challenges that stimulate innovation and offers numerous novel and unconventional solutions to mathematical problems, inspiring a fresh perspective.

Leadership and decision-making:

Table 8. Results of Analyzing the Implementation of Leadership and Decision-Making

Sub skills	First semester	Percentage	Second semester	Percentage	Total	Percentage
Encouraging students to achieve personal goals through mathematical planning	3	9.6%	4	10.8%	7	10.2%
Finding multiple solutions to the same mathematical problem	6	19.3%	7	18.9%	13	19.1%
Encouraging professional team leadership	3	9.6%	4	10.8%	7	10.2%
Making decisions based on mathematical evidence	6	19.3%	7	18.9%	13	19.1%
Encouraging decision-making to solve real problems related to society and students' daily lives	7	22.5%	8	21.6%	15	22.05%
Encouraging leadership skills through exploration of different mathematical situations.	6	19.3%	7	18.9%	13	19.1%
Total	31	13.1%	37	14.17%	68	13.7%

Table (8) clearly shows that 13.7% of leaders and decision-making skills were included in the eighth-grade mathematics curriculum; the highest percentage was 22.5%, and the lowest was 10.2%. The results refer to the decision-making skills that are developed by math situations related to society and students' daily lives; however, leadership skills are also needed.

The result can be explained by some mathematical problems requiring the skill of making decisions about the type of mathematical laws to be used based on the given data. Leadership skills can be developed by diversifying the

educational activities and situations that require them.

Local and Global Citizenship:

Table 9. Results of Analyzing the Implementation of Local and Global Citizenship

Sub skills	First semester	Percent age	Second semester	Percent age	Total	Percent age
promoting respect for different cultures.	2	11.1%	2	10%	4	10.5%
Helping learners to have awareness of global challenges	3	16.6%	2	10%	5	13.1%
including teaching situations with increasingly complex local and global mathematics projects	4	22.2%	5	25%	9	23.6%
Contributing to the development of environmental sustainability behaviors through different mathematical situations.	2	11.1%	1	5%	3	7.8%
Encouraging the use of mathematics to solve certain local problems	3	16.6%	5	25%	8	21.05%
Emphasizing noble human values	2	11.1%	3	15%	5	13.1%
Total	18		20		38	7.6%

Table 9 indicates that the percentage of integrating local and global citizenship skills in the eighth-grade mathematics curriculum is 7.6%; the highest percentage is for teaching situations with increasingly complex local and global citizenship (23.6%), and the lowest is for development of environmental sustainability behaviors (7.8%).

The result shows that some local and global citizenship skills were indicated. This is due to the mathematical problems, which include much information related to the reality of the Bahraini student's life and the nature of Bahraini society, which embraces many global cultures. It is possible to include some issues concerning the environment in the curriculum.

Entrepreneurship and Initiative:

Table 10. Results of Analyzing the Implementation of Entrepreneurship and Initiative

Sub skills	First semester	Percent age	Second semester	Percent age	Total	Percent age
Presenting mathematics initiatives to solve local challenges	6	19.3%	5	16.6%	11	18.03%
Developing responsibility through mathematical situations with their teams	5	16.1%	4	13.3%	9	14.7%
Developing the skills of risk analysis	2	6.4%	2	6.6%	4	6.5%
Volunteering and interpreting through enriching math activities	6	19.3%	7	23.3%	13	21.3%
Improving the skills of interpreting mathematical data and information.	6	19.3%	7	23.3%	13	21.3%
Developing skills of adaptation to various roles in math activities	3	9.6%	2	6.6%	5	8.1%
Encouraging the learners to benefit from each other.	3	9.6 %	3	10%	6	9.8%
Total	31	13.1%	30	11.4%	61	12.2%

The percentage in Table (10) of Entrepreneurship and Initiative in the eighth-grade mathematics curriculum is (12.2%). The highest percentage (21.3%) is for mathematical situations that help learners to define problems and plan for solutions, on the one hand, and to improve the ability to interpret mathematical data and information, on the other hand. The lowest percentage, 6.5%, is for developing the skills of risk analysis.

The result may be due to the nature of the mathematics subject, which is rich in data and educational situations that

address the student's daily problems. As for the risk analysis skill, developing this skill may require an academic level higher than the eighth grade.

Technological Literacy:

Table 11. Results of Analyzing the Implementation of Technological Literacy

Sub skills	First semester	Percentage	Second semester	Percentage	Total	Percentage
promoting positive attitudes toward the use of technology in math	3	8.8%	3	7.8%	6	8.3%
Using digital technologies to find solutions for different mathematical situations.	7	20.5%	5	13.1%	12	16.6%
Providing access to math information through digital technologies	6	23.5%	9	15.7%	15	20.8%
Making judgments on the effectiveness of math information provided by digital technologies	2	5.8%	1	2.6%	3	4.1%
Using technology effectively on an individual level	2	5.8%	2	5.2%	4	5.5%
Using digital programs that convert data into symbols and graphs	3	8.8%	5	13.1%	8	11.1%
Using technology effectively at the team level	2	5.8%	3	7.8%	5	6.9%
Providing flexibility with the rapid change in technology tools	2	5.8%	3	7.8%	5	6.9%
Providing Contributions to Digital Content Production	3	8.8%	3	7.8%	6	8.3%
Commitment to ethical issues related to digital content	4	11.4%	4	10.5	8	11.1%
Total	34	14.4%	38	14.5%	72	14.5%

According to Table (11), the percentage of Technological literacy skills in the eighth-grade mathematics curriculum is (14.5%); the highest percentage is for providing access to information through digital technologies (20%). The lowest is (4.1%) which means that the student has little knowledge of making judgments on the effectiveness of sports information provided by digital technologies.

Language Empowerment:

Table 12. Results of Analyzing the Implementation of Language Empowerment

Sub skills	First semester	Percentage	Second semester	Percentage	Total	Percentage
Developing skills in writing and speaking through mathematical symbolics.	6	20.6%	7	21.2%	13	20.9%
Enhancing the spirit of national belonging	4	13.7%	5	15.1%	9	14.5%
Enhancing the spirit of cultural heritage through various mathematical issue	4	13.7%	3	9.09%	7	11.2%
Promoting national identity through mathematical issues	4	13.7%	5	15.1%	9	14.5%
Enhancing the use of the mother tongue	8	27.5%	10	30.3%	18	29.03%
Contributing to enhance mathematics communication with people from multilingual environments	3	10.3%	3	9.09%	6	9.6%
Total	29	12.3%	33	12.6%	62	12.5%

Table (12) indicates that 12.5% of Language Empowerment skills are implemented in the eighth-grade mathematics curriculum; the highest percentage is for enhancing the use of the mother tongue (29.03%), and the lowest is for contributing to enhancing mathematics communication with people from multilingual environments (9.6%).

The researcher explained this result by mentioning that the book's language is Arabic, which explains verbal

communication in Arabic. It is recommended that valuable materials in teaching should be added to ensure students are motivated to communicate with other students from different diverse cultural backgrounds.

4. Discussion

The analysis revealed a significant integration of twenty-first-century skills in the eighth-grade mathematics curriculum over two semesters. This achievement is a testament to the Bahraini Ministry of Education's unwavering commitment to curriculum development and ensuring learners are equipped with the necessary skills for future success. The importance of these skills is underscored by their role in the development of mathematics (Al-Mutawah & Fateel, 2018).

The impact of the mathematics curriculum on student performance, particularly at TIMSS, is a topic of great interest. This research has highlighted the high availability of 21st-century skills in the eighth-grade mathematics curriculum and the significant improvement in TIMSS assessments. This success underscores the importance of integrating science, technology, engineering, and technology education into mathematics curricula to foster the development of these skills (Steehle & perton, 2019). Furthermore, the curriculum should consider the factors that mediate between the curriculum and students' performance (Robbins. 2017).

Furthermore, it is essential to highlight the crucial role that mathematics teachers play in helping achieve these good results; therefore, content selection influences learners' participation and success in mathematics. To maximize and enhance students' involvement with the material, it is essential to choose content that is both practical and pertinent to their personal experiences and ambitions for future professional opportunities. (Macintyre, Hamilton. 2010). However, there are a few pieces of evidence for a differential effect of curriculum materials on students' mathematics performance results (Van Steenbrugge et al., 2010), and this research may give one of these pieces. Overall, the impact of the mathematics curriculum on students' results at TIMSS is influenced by various factors, including the teacher's role and the alignment of the curriculum with 21st-century skills.

Based on the results of the descriptive and preliminary analysis, it was obvious that the high percentage of digital literacy is due to the many digital programs in the mathematics curriculum. These programs require students to use digital skills suitable for their age and help develop specific skills beneficial for their future work environments. This was ensured by Niemi et al. (2018) and Cheng et al. (2010), who demonstrated the importance of employing digital technology or video games along with 21st-century skills in mathematics curriculum content. On the other hand, studies by Altakhayneh (2022) showed inconsistent results that indicate low technology skills and high collaboration and teamwork.

Referring to this study, the low percentage of local and global citizenship skills was because of the need for more emphasis placed on them within the context of the mathematics curriculum. Furthermore, this study's results show a close ratio of leadership, decision-making, creativity, problem-solving, and critical thinking skills. The mathematics curriculum includes situations that develop decision-making and opportunities to solve mathematical problems independently. These results are because of the nature of mathematics, which is rich in mathematical situations that require information and data interpretation, in addition to being a fertile field of training. Students learn the patterns and methods of rational thinking through activities and mathematical questions. The results are consistent and compatible with mathematical and logical thinking and inductive reasoning, which goes along with the results of the English & Sriraman (2009) study that showed the role of mathematical approaches in acquiring mathematical problem-solving abilities through adapting methods of finding mathematical solutions. At the same time, the study by Altakhayneh (2022) showed a percentage of critical thinking, creativity, innovation, and the most minor communication skills. However, ŞENGÜL et al. (2021) observed a crucial gap in the mathematics curriculum. They noted that it fails to encompass all 21st-century skills, particularly media literacy, leadership, and responsibility skills. This deficiency underscores the need to Include alternative evaluation methods in the curriculum, which is imperative to ensure the attainment of teaching goals within 21st-century skills.

Finally, the mathematics curriculum has a significant role in developing 21st-century skills. This goes along with the studies of English and Kirshner (2015) that showed the effectiveness of problem-solving skills in developing 21st-century skills and providing students with a cross-curricular experience with real-world meaning. However, a study by Rokhmaniyah et al. (2021) emphasized the role of curriculum in improving the skills of entrepreneurs by developing a model of entrepreneurial curriculum based on science, technology, art, engineering, mathematics, and society (STEAMS). Radmehr & Vos's (2020) study demonstrated the critical role of cycle three schools in developing students' entrepreneurial skills as one of the crucial 21st-century skills.

5. Conclusion

The study aimed to measure twenty-first-century skills in grade eight math curriculum in public schools in the Kingdom of Bahrain and conducted using the descriptive-analytical method to analyze the contents of the books using a content-analysis card.

The results showed a very high percentage (92.20%) of twenty-first-century skills integration in eighth-grade math books.

Overall, the study showed that the widespread opportunity for 21st-century skills in the mathematics curriculum impacts students' abilities to obtain high grades in the TIMSS exams. This suggests that integrating science, technology, engineering, and mathematics education into mathematics curricula can provide convenience for students to evolve 21st-century skills in a consequential and effective way.

6. Recommendations

Based on the results of the study, the researcher recommends the following:

1. Organize training courses, seminars, and workshops for mathematics teachers to clarify the importance of integrating 21st-century skills in teaching math and how to apply them while teaching.

2. Curriculum planners and developers of mathematics programs should consider 21st-century skills and reconsider the focus of these skills in the mathematics curriculum.

Based on the results of the study, the researcher proposed:

1. Preparing future studies to determine whether mathematics teachers are skillful in 21st-century skills.

2. Designing training programs to develop the skills of 21st-century mathematics teachers in the education phase.

3. Preparing analytical research on 21st-century skills for other academic subjects at different phases.

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