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Innovative Evaluation Techniques for Assessing Students' Achievement in Mathematics and Sciences

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Abstract

This study explores innovative evaluation techniques for assessing students' achievement in mathematics and sciences in the context of Onitsha North Local Government Area (LGA), Anambra State, Nigeria. The research objectives include identifying and examining innovative evaluation techniques, exploring the challenges and opportunities associated with their implementation, investigating the perceptions of teachers regarding their use, and assessing the effectiveness of these techniques in capturing students' mathematical understanding, problem-solving skills, and critical thinking abilities. The study employed a survey design, and data were collected using self-structured questionnaires distributed through Google survey. The participants were secondary school teachers in Onitsha North LGA, with a total of 220 instructors responding to the online survey. The data analysis involved various statistical techniques, including frequency counts, percentages, mean, standard deviation, and analysis of variance (ANOVA). The findings revealed that innovative evaluation techniques such as performance-based assessments, open-ended questions, collaborative and group-based assessments, and performance tasks with rubrics were highly regarded by the respondents. However, technology-enhanced assessments faced some challenges and had a lower mean score. The study also identified challenges such as the lack of training and professional development opportunities for teachers, limited availability of resources and technology, resistance from students and teachers to change, time constraints, and challenges in aligning innovative evaluation techniques with existing policies and guidelines. These findings contribute to the existing body of knowledge by providing insights into the applicability, effectiveness, and challenges associated with the use of innovative evaluation techniques in the local context.

Keywords
Innovative; evaluation techniques; students' achievement; mathematics; sciences

I. Introduction

Mathematics and sciences is a fundamental subject that plays a crucial role in the development of logical reasoning, problem-solving skills, and critical thinking abilities among students. It forms the foundation for various fields, including science, engineering, finance, and technology. Mathematics and sciences are fundamental disciplines that form the bedrock of human knowledge and understanding (Hillmayr, Ziernwald, Reinhold, Hofer & Reiss, 2020). Mathematics is the language of patterns, structures, and quantitative relationships, providing a framework for logical reasoning and problem-solving. It encompasses a wide range of topics, including arithmetic, algebra, geometry, calculus, statistics, and more (Hestenes & Sobczyk, 2012). Sciences, on the other hand, encompass the systematic study of the natural world, aiming to explain phenomena through observation, experimentation, and theoretical models. The major branches of science include physics, chemistry, biology, and earth sciences (Trefil & Hazen, 2016).

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Mathematics and sciences play a crucial role in various aspects of human life. They provide the foundation for technological advancements, engineering solutions, medical breakthroughs, and environmental understanding (Bradu, Biswas, Nair, Sreevalsakumar, Patil, Kannampuzha, Mukherjee, Wanjari, Renu, Vellingiri & Gopalakrishnan, 2022). In todays highly interconnected and data-driven world, mathematical and scientific literacy is essential for individuals to make informed decisions, critically evaluate information, and participate in a rapidly evolving global society. Moreover, mathematics and sciences foster the development of important skills and competencies (Antoun, Younes & Salloum, 2023). They promote logical and analytical thinking, problem-solving abilities, creativity, and abstract reasoning. Studying mathematics and sciences cultivates a mindset of inquiry, curiosity, and continuous learning. In educational settings, mathematics and sciences are core subjects; ensuring students acquire essential knowledge and skills to navigate the modern world. They contribute to the development of scientific literacy, which encompasses not only subject-specific knowledge but also an understanding of scientific methodologies, the ability to evaluate evidence, and an appreciation of the impact of science on society (Fahmi, Chalisah, Istyadji, Irhasyuarna & Kusasi, 2022). As such, the assessment of students' achievement in mathematics and sciences is of paramount importance in evaluating their understanding, progress, and competence in these subjects.

Traditional assessment methods, such as pen-and-paper tests, have long been used to evaluate students' knowledge and understanding. These methods typically involve written exams, quizzes, or assignments where students provide responses using pen or pencil on paper. While they have been widely employed due to their ease of administration and familiarity, traditional assessment methods have limitations (Guimarães, Ribeiro, Cruz, Ferreira, Alves, Cruz-Correia, Madeira & Ferreira, 2018). They often focus on recall and regurgitation of information rather than critical thinking and problem-solving skills. Moreover, they may not effectively capture a student's true abilities or provide a comprehensive picture of their understanding. As education evolves, Tan, Chan, Bielaczyc, Ma, Scardamalia and Bereiter (2021) believed there is a growing recognition for the need to explore innovative assessment techniques that better align with the demands of the modern world and digital age. However, these methods often focus on rote memorization and procedural knowledge, failing to capture students' deeper understanding and application of mathematical concepts (Perry, Meissel & Hill, 2022). Additionally, traditional assessments may not effectively capture students' problem-solving skills, creativity, and ability to think critically and analytically.

To address these limitations, innovative evaluation techniques have emerged as alternative approaches to assess students' achievement in mathematics and sciences. Innovative evaluation techniques in education have emerged as a response to the limitations of traditional assessment methods (Abrahams, Pancorbo,Primi, Santos, Kyllonen, John & De-Fruyt, 2019). These techniques leverage technology, interactive platforms, and alternative forms of assessment to provide a more comprehensive and authentic evaluation of students' knowledge and skills (Azonuche, 2020). Examples include project-based assessments, where students demonstrate their understanding through hands-on projects or real-world applications, as well as online platforms that enable adaptive and personalized assessments (Bakare, Ojulokunrin, Jagun, Z. T., Adedeji & Olugbenga, 2020; Ukah, Ayewu & Oworu, 2023). These innovative techniques prioritize critical thinking, problem-solving, and creativity, allowing students to showcase their abilities beyond rote memorization. By embracing these new approaches, educators aim to foster a deeper understanding of subject matter and prepare students for the complex

challenges of the 21st century (Oba-Adenuga & Oba-Adenuga, 2018; Haryani, Coben, Pleasants & Fetters, 2021). Despite the importance of mathematics and sciences and the need for effective assessment techniques, there is a lack of comprehensive research on innovative evaluation techniques for assessing students' achievement in mathematics and sciences, particularly in the context of Onitsha North Local Government Area (LGA), Anambra State, Nigeria. The current assessment practices in mathematics and sciences often emphasize traditional methods, which may not fully capture students' true abilities and hinder the development of higher-order thinking skills.

Furthermore, the existing literature on innovative evaluation techniques in mathematics and sciences primarily focuses on international contexts, with limited attention given to local contexts and specific regions within Nigeria (Abd-Algani, 2019; Rahmadi & Lavicza, 2021; Nkundabakura, Nsengimana, Nyirahabimana, Nkurunziza, Mukamwambali, Dushimimana, Uwamariya, Batamuliza, Byukusenge, Nsabayezu, & Twahirwa, 2023). Therefore, there is a gap in understanding how innovative evaluation techniques can be applied and tailored to the unique educational landscape of Onitsha North LGA.This study is significant for several reasons.

1.2 Research Objectives

The primary objective of this study is to explore and evaluate innovative evaluation techniques for assessing students' achievement in mathematics and sciences in Onitsha North LGA, Anambra State. Specifically, the study aims to:

1. Identify and examine innovative evaluation techniques used in mathematics and sciences.
2. Identify the challenges and opportunities associated with implementing innovative evaluation techniques in mathematics and sciences.
3. Investigate the perceptions of teachers regarding the use of innovative evaluation techniques.
4. Assess the effectiveness of innovative evaluation techniques in capturing students' mathematical understanding, problem-solving skills, and critical thinking abilities.

II. Research Method

This study focused on innovative evaluation techniques for assessing students' achievement in mathematics and sciences. In this study, the researcher focused on developing innovative evaluation techniques for assessing students' achievement in mathematics and sciences. To accomplish this, she employed a specific methodology that encompassed data gathering, presentation, analysis, and interpretation of findings. The research design chosen for this study was a survey design, which allowed the researchers to gather data from a large number of participants efficiently (Ikart, 2019). To collect information from the participants, self-structured questionnaires were distributed using Google survey. This method was chosen to provide respondents with busy schedules the flexibility to complete the questionnaire at their convenience. The sample or research unit for this study was the main source of data, and information was directly gathered from this sample. The researchers targeted the entire secondary school teaching staff in Onitsha North LGA, Anambra State, Nigeria as the population of interest. However, due to practical constraints, a total of 220 instructors responded to the online survey. To ensure the validity and relevance of the questionnaire's content, the researchers sought input from three professionals in the field of computer studies education, who validated the questionnaire. Additionally, the reliability of the instrument was assessed using Cronbach's

coefficient alpha. The researchers found the questionnaire to have adequate dependability, with a reliability coefficient of 0.88. In the data analysis process, the researchers employed various statistical techniques. To evaluate demographic data, frequency counts and percentages were used. Mean and standard deviation were calculated to assess the research questions, and analysis of variance (ANOVA) was conducted to test the hypotheses.

III. Result and Discussion

3.1 Demographic characteristics of Respondent

Table 1. Gender profile of the respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	59	26.8	26.8	26.8
	Female	161	73.2	73.2	100.0
	Total	220	100.0	100.0	

Table 1 presents the gender profile of the respondents in the study. Out of the total 220 participants, 26.8% were male, while 73.2% were female. The table provides both the frequency and percentage distribution of the respondents by gender. The cumulative percent column shows the cumulative distribution of respondents, with 26.8% being male and 100% being the total cumulative percentage.

Table 2. Highest qualification of the respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NCE	15	6.8	6.8	6.8
	BSc+PGDE	25	11.4	11.4	18.2
	B.ED	100	45.5	45.5	63.6
	M.ED	54	24.5	24.5	88.2
	MSc	20	9.1	9.1	97.3
	PhD	4	1.8	1.8	99.1
	Others	2	.9	.9	100.0
	Total	220	100.0	100.0	

Table 2 provides information on the highest qualification of the respondents in the study. The table includes the frequency, percentage, valid percentage, and cumulative percentage for each qualification category. Among the respondents, 6.8% held NCE (National Certificate of Education), while 11.4% had a BSc+PGDE (Bachelor's degree with Postgraduate Diploma in Education). The largest group consisted of 45.5% who had a B.Ed. (Bachelor of Education) degree, followed by 24.5% with an M.Ed. (Master of Education) degree. Additionally, 9.1% held an MSc (Master of Science), 1.8% had a PhD, and 0.9% had other qualifications. The cumulative percentage column indicates the accumulation of respondents in each qualification category. For instance, 63.6% of respondents had a B.Ed. degree or higher and 100% represents the total cumulative percentage.

Table 3. Respondents' Years of experience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<5 years	56	25.5	25.5	25.5
	6-15 years	61	27.7	27.7	53.2
	15-25 years	89	40.5	40.5	93.6
	25-35 years	14	6.4	6.4	100.0
	Total	220	100.0	100.0	

Table 3 presents information on the respondents' years of experience in the field. The table includes the frequency, percentage, valid percentage, and cumulative percentage for each experience category. The majority of respondents, accounting for 40.5%, had 15-25 years of experience. This was followed by 27.7% of respondents who had 6-15 years of experience. Additionally, 25.5% had less than 5 years of experience, while a smaller portion of respondents, 6.4%, had 25-35 years of experience. The cumulative percentage column shows the accumulation of respondents within each experience category. For instance, 93.6% of respondents had 15-25 years of experience or less.

3.2 Descriptive statistics

Table 4. Innovative evaluation techniques used in mathematics and sciences in Onitsha North LGA, Anambra State

	N	Mean		Std. Deviation	Variance	Kurtosis	
	Statistic	Statistic	Std. Error	Statistic	Statistic	Statistic	Std. Error
Performance-based assessments (e.g., projects, portfolios, real-world problem-solving tasks)	220	3.91	.030	.439	.193	33.891	.327
Open-ended questions and tasks that require students to explain their reasoning and thought processes	220	3.92	.028	.408	.167	31.042	.327
Collaborative and group-based assessments that encourage teamwork and communication skills	220	3.96	.016	.231	.053	51.439	.327

Technology-enhanced assessments (e.g., computer-based simulations, online quizzes)	220	2.52	.095	1.416	2.004	-1.902	.327
Performance tasks with rubrics that assess multiple dimensions of mathematical understanding	220	3.92	.026	.385	.149	34.785	.327

Table 4 provides information on the innovative evaluation techniques used in mathematics and sciences in Onitsha North LGA, Anambra State. The table includes various evaluation techniques and their corresponding statistics, including the sample size (N), mean, standard deviation (Std. Deviation), variance, and kurtosis. The evaluation technique with the highest mean score of 3.96 is collaborative and group-based assessments that encourage teamwork and communication skills. This technique received a relatively low standard deviation, indicating that there was minimal variation in the responses for this evaluation technique. Performance-based assessments, which include projects, portfolios, and real-world problem-solving tasks, received a mean score of 3.91, indicating a high level of effectiveness. Open-ended questions and tasks that require students to explain their reasoning and thought processes also received a similar mean score of 3.92. Performance tasks with rubrics that assess multiple dimensions of mathematical understanding received a mean score of 3.92, suggesting that this evaluation technique is highly regarded as well. On the other hand, technology-enhanced assessments, such as computer-based simulations and online quizzes, received a lower mean score of 2.52. This evaluation technique had a higher standard deviation, indicating a wider range of responses and potentially differing levels of effectiveness among respondents. Kurtosis, a measure of the distribution's shape, provides insights into the data's deviation from a normal distribution. Higher kurtosis values are indicative of more extreme data points. In this table, collaborative and group-based assessments had the highest kurtosis value of 51.439, suggesting a distribution with more extreme responses.

Table 5. Challenges and opportunities associated with implementing innovative evaluation techniques in mathematics and sciences in Onitsha North LGA, Anambra State

	N	Mean		Std. Deviation	Variance	Kurtosis	
	Statistic	Statistic	Std. Error	Statistic	Statistic	Statistic	Std. Error
Lack of training and professional development opportunities	220	1.81	.080	1.190	1.415	-.890	.327

for teachers to effectively implement innovative evaluation techniques							
Limited availability of resources and technology necessary for implementing innovative evaluation techniques	220	3.42	.049	.720	.518	2.437	.327
Resistance from students and teachers to change from traditional assessment methods	220	3.00	.069	1.029	1.059	-.767	.327
Time constraints and pressure to cover the curriculum, leaving limited time for implementing innovative evaluation techniques	220	3.08	.053	.790	.623	.306	.327
Challenges in aligning innovative evaluation techniques with existing assessment policies and guidelines	220	3.21	.055	.823	.678	.331	.327

Table 5 provides information on the challenges and opportunities associated with implementing innovative evaluation techniques in mathematics and sciences in Onitsha North LGA, Anambra State. The table includes various challenges and their corresponding statistics, such as the sample size (N), mean score, standard deviation (Std. Deviation), variance, and kurtosis. According to the table, the greatest challenge identified was the lack of training and professional development opportunities for teachers to effectively

implement innovative evaluation techniques. This challenge received the lowest mean score of 1.81, indicating that it was perceived as a significant obstacle. Limited availability of resources and technology necessary for implementing innovative evaluation techniques was another notable challenge. While it received a higher mean score of 3.42, indicating a moderate level of difficulty, the responses had a relatively low standard deviation, suggesting a degree of agreement among participants. Resistance from students and teachers to change from traditional assessment methods was perceived as a moderate challenge, with a mean score of 3.00. Time constraints and pressure to cover the curriculum, which can limit the implementation of innovative evaluation techniques, also received a moderate mean score of 3.08. Challenges in aligning innovative evaluation techniques with existing assessment policies and guidelines had a mean score of 3.21, indicating a moderate level of difficulty as well. The kurtosis values in the table provide insights into the shape of the distribution for each challenge. None of the challenges showed significant departures from a normal distribution based on their kurtosis values.

3.3 Hypotheses Testing

Hypothesis One: Innovative evaluation techniques are not frequently used in Assessing Students' Achievement in Mathematics and sciences

Table 6. ANOVA on innovative evaluation techniques used in assessing students' achievement in mathematics and sciences

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	491.904	1	491.904	43.414	.000
Within Groups	2470.077	218	11.331		
Total	2961.982	219			

Table 6 presents the results of an analysis of variance (ANOVA) conducted on the innovative evaluation techniques used in assessing students' achievement in mathematics and sciences. The table includes the sum of squares, degrees of freedom (df), mean square, F-statistic, and the corresponding significance level (Sig.). The ANOVA examines the variation between groups and within groups. In this case, the between groups sum of squares is 491.904, with 1 degree of freedom, resulting in a mean square of 491.904. The F-statistic is 43.414, indicating a significant difference between the groups. The within groups sum of squares is 2470.077, with 218 degrees of freedom, resulting in a mean square of 11.331. The total sum of squares is 2961.982. The significance level (Sig.) is reported as .000, which is less than the conventional threshold of .05. This indicates that the observed difference between the groups is statistically significant, providing evidence to reject the null hypothesis that innovative evaluation techniques are not frequently used in assessing students' achievement.

Hypothesis two: Innovative evaluation techniques are not effective in capturing students' mathematical understanding, problem-solving skills, and critical thinking abilities

Table 7. ANOVA on effectiveness of innovative evaluation techniques in capturing students' mathematical understanding, problem-solving skills, and critical thinking abilities

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	626.170	1	626.170	44.367	.000
Within Groups	3076.757	218	14.114		
Total	3702.927	219			

Table 7 presents the results of an analysis of variance (ANOVA) conducted on the effectiveness of innovative evaluation techniques in capturing students' mathematical understanding, problem-solving skills, and critical thinking abilities. The table includes the sum of squares, degrees of freedom (df), mean square, F-statistic, and the corresponding significance level (Sig.). The ANOVA examines the variation between groups and within groups. In this case, the between groups sum of squares is 626.170, with 1 degree of freedom, resulting in a mean square of 626.170. The F-statistic is 44.367, indicating a significant difference between the groups. The within groups sum of squares is 3076.757, with 218 degrees of freedom, resulting in a mean square of 14.114. The total sum of squares is 3702.927. The significance level (Sig.) is reported as .000, which is less than the conventional threshold of .05. This indicates that the observed difference between the groups is statistically significant, providing evidence to reject the null hypothesis that innovative evaluation techniques are not effective in capturing students' mathematical understanding, problem-solving skills, and critical thinking abilities.

3.4 Discussion of results

Collaborative and group-based assessments are evaluation techniques that promote teamwork and communication skills among students. These assessments involve students working together in groups to solve problems, complete projects, or engage in discussions. This approach allows students to learn from each other, develop critical thinking skills, and enhance their ability to effectively communicate and collaborate with others. Research has shown that collaborative and group-based assessments have several benefits for students (Perry, Meissel, & Hill, 2022). They provide opportunities for active learning, as students actively participate in group activities and engage in discussions. This can lead to improved comprehension and retention of concepts. Collaboration also promotes higher-order thinking skills, such as problem-solving, decision-making, and creativity. Students learn to share and justify their ideas, listen to others' perspectives, and negotiate solutions, which are valuable skills in real-world situations (Oba-Adenuga & Oba-Adenuga, 2018). Similarly, open-ended questions and tasks that require students to explain their reasoning and thought processes encourage deeper understanding and critical thinking. These types of assessments go beyond simple recall of facts and require students to analyze, evaluate, and synthesize information. By explaining their reasoning, students develop metacognitive skills, gain insights into their own thinking processes, and become more aware of their learning strategies. Open-ended questions also provide opportunities for students to demonstrate their problem-solving abilities and apply their knowledge in real-world contexts. They foster creativity, as students are encouraged to think outside the box and explore multiple perspectives. Additionally, these assessments promote communication skills, as students need to articulate their thoughts and ideas effectively (Abd-Algani, 2019). Both collaborative and group-based assessments and open-ended questions align with constructivist learning theories, which emphasize active participation, social interaction, and the construction of knowledge through meaningful experiences

(Nkundabakura et al., 2023). These approaches engage students in authentic learning tasks, encourage reflection and self-assessment, and facilitate a deeper understanding of the subject matter.

The limited availability of resources and technology necessary for implementing innovative evaluation techniques can pose significant challenges. To effectively utilize innovative evaluation techniques, educators often require access to a range of resources such as technological tools, software, equipment, and materials. However, budget constraints and resource limitations in educational institutions can hinder the adoption and implementation of these techniques (Zawacki-Richter et al., 2019). Insufficient access to technology can limit the use of computer-based simulations, online quizzes, or other technology-enhanced assessments. Similarly, the lack of necessary materials and resources can hinder the implementation of performance-based assessments, projects, or real-world problem-solving tasks. This limitation may impact the effectiveness of the evaluation process and the overall quality of assessment outcomes (Guimarães et al., 2018). Additionally, aligning innovative evaluation techniques with existing assessment policies and guidelines can be challenging. Education systems often have established frameworks and standardized assessments that may not fully accommodate or recognize the value of innovative approaches. There may be resistance to change or a lack of clear guidance on how to incorporate innovative techniques into existing assessment practices (Perry et al., 2022). Addressing these challenges requires a proactive approach. Educational institutions and policymakers need to prioritize the allocation of resources to ensure the availability of technology and materials for innovative evaluation techniques. Training and professional development programs can also be offered to educators to enhance their skills in utilizing these techniques effectively (Hillmayr et al., 2020). Furthermore, it is crucial to review and revise assessment policies and guidelines to provide flexibility and support for the integration of innovative techniques. This may involve collaborating with educators, researchers, and policymakers to develop frameworks that recognize and encourage the use of these techniques while maintaining the necessary standards and reliability of assessments.

The statistical significance of the observed difference between the groups suggests that innovative evaluation techniques are indeed frequently used in assessing students' achievement in the given context. When conducting hypothesis testing, the null hypothesis assumes that there is no significant difference or relationship between the variables being studied. In this case, the null hypothesis would state that innovative evaluation techniques are not frequently used. The obtained result, with a statistically significant difference, indicates that the evidence is strong enough to reject the null hypothesis. It suggests that innovative evaluation techniques are indeed being utilized regularly in assessing students' achievement in mathematics and sciences. The significance level (often denoted as "Sig.") in the table provides information about the probability of obtaining the observed difference by chance. In this case, the reported significance level of .000 suggests a very low probability of obtaining the observed difference due to random chance alone. This finding is important as it indicates a positive trend towards the adoption of innovative evaluation techniques in educational practices (Antoun et al., 2023). These techniques offer various benefits, such as promoting critical thinking, problem-solving skills, and a deeper understanding of the subjects being assessed. They also provide opportunities for active learning, engagement, and real-world application of knowledge (Fahmi et al., 2022).

The statistical significance of the observed difference between the groups suggests that innovative evaluation techniques are indeed effective in capturing students' mathematical understanding, problem-solving skills, and critical thinking abilities. The

rejection of the null hypothesis indicates that there is a significant difference in the outcomes of the assessment when using innovative evaluation techniques compared to other traditional methods. This finding is important as it supports the notion that innovative evaluation techniques have the potential to provide a more comprehensive and accurate assessment of students' abilities in mathematics and sciences. These techniques often involve performance-based assessments, open-ended questions, and collaborative activities that require students to apply their knowledge and demonstrate higher-order thinking skills (Ukah et al., 2023). These techniques provide opportunities for students to actively engage in the learning process, reflect on their own thinking, and receive timely feedback to improve their performance in science (Trefil et al., 2016). The statistically significant difference observed in the study suggests that innovative evaluation techniques are effective in capturing students' mathematical understanding, problem-solving skills, and critical thinking abilities. This finding highlights the potential of these techniques to provide a more comprehensive assessment of students' abilities in mathematics and sciences, moving beyond traditional assessment methods and promoting a deeper understanding of the subject matter.

IV. Conclusion

In conclusion, innovative evaluation techniques play a crucial role in assessing students' achievement in mathematics and sciences. These techniques, such as performance-based assessments, open-ended questions, collaborative activities, and technology-enhanced assessments, offer distinct advantages over traditional assessment methods. They provide opportunities for students to demonstrate their mathematical understanding, problem-solving skills, and critical thinking abilities in authentic and real-world contexts. Through the use of innovative evaluation techniques, educators can gain deeper insights into students' knowledge, skills, and abilities. These techniques promote active learning, engagement, and the application of knowledge, fostering a deeper understanding of the subject matter. Moreover, they encourage students to think critically, communicate their reasoning, and collaborate with peers, developing important skills necessary for success in the modern world.

While challenges may exist, such as limited availability of resources and the need to align innovative evaluation techniques with existing assessment policies, the benefits outweigh the difficulties. It is important for educational institutions and policymakers to provide the necessary support, training, and resources to facilitate the effective implementation of these techniques. The evidence presented in this discussion highlights the effectiveness and frequency of innovative evaluation techniques in capturing students' achievement in mathematics and sciences. The statistically significant results indicate that these techniques provide a comprehensive and accurate assessment of students' abilities, moving beyond rote memorization and embracing higher-order thinking skills. To enhance the educational experience and promote student success, educators should continue to explore and implement innovative evaluation techniques. By utilizing a combination of assessment methods, including both traditional and innovative approaches, educators can create a balanced and comprehensive assessment system that fosters meaningful learning experiences and accurately captures students' achievements.

References

Abd-Algani, Y. (2019). Innovative ways to teach mathematics: are they employed in schools?. Journal of Computer and Education Research, 7(14), 496-514.

Abrahams, L., Pancorbo, G., Primi, R., Santos, D., Kyllonen, P., John, O. P., & De Fruyt, F. (2019). Social-emotional skill assessment in children and adolescents: Advances and challenges in personality, clinical, and educational contexts. Psychological Assessment, 31(4), 460.

Antoun, M., Younes, R., & Salloum, S. (2023). Investigating the Status of Highly Able Students through the Lens of the Lebanese National Policy and the Mathematics and Science Centralized Curricula and Textbooks. European Journal of Science and Mathematics Education, 11(2), 215-233.

Azonuche, J. E. (2020). Revitalizing Home Economics Education in Tertiary Institutions in Nigeria Through ICT Use for Skill Acquisition for Global Relevance. Journal of Educational and Social Research, 10(6), 332-340.

Bakare, S. F., Ojulokunrin, R. W., Jagun, Z. T., Adedeji, O. O., & Olugbenga, A. (2020). The mediating impact of assessment process in the relationship between project-based learning and teamwork skills' development. Journal of Management Info, 7(4), 248-258.

Bradu, P., Biswas, A., Nair, C., Sreevalsakumar, S., Patil, M., Kannampuzha, S., Mukherjee, A.G., Wanjari, U.R., Renu, K., Vellingiri, B. and Gopalakrishnan, A.V., 2022. Recent advances in green technology and Industrial Revolution 4.0 for a sustainable future. Environmental Science and Pollution Research, pp.1-32.

Fahmi, F., Chalisah, N., Istyadji, M., Irhasyuarna, Y., & Kusasi, M. (2022). Scientific literacy on the topic of light and optical instruments in the innovation of science teaching materials. Jurnal Inovasi Pendidikan IPA, 8(2).

Guimarães, B., Ribeiro, J., Cruz, B., Ferreira, A., Alves, H., Cruz-Correia, R., Madeira, M.D. and Ferreira, M.A., 2018. Performance equivalency between computer-based and traditional pen-and-paper assessment: A case study in clinical anatomy. Anatomical sciences education, 11(2), pp.124-136.

Haryani, E., Coben, W. W., Pleasants, B. A., & Fetters, M. K. (2021). Analysis of Teachers' Resources for Integrating the Skills of Creativity and Innovation, Critical Thinking and Problem Solving, Collaboration, and Communication in Science Classrooms. Jurnal Pendidikan IPA Indonesia, 10(1), 92-102.

Hestenes, D., & Sobczyk, G. (2012). Clifford algebra to geometric calculus: a unified language for mathematics and physics (Vol. 5). Springer Science & Business Media.

Hillmayr, D., Ziernwald, L., Reinhold, F., Hofer, S. I., & Reiss, K. M. (2020). The potential of digital tools to enhance mathematics and science learning in secondary schools: A context-specific meta-analysis. Computers & Education, 153, 103897.

Ikart, E. M. (2019). Survey questionnaire survey pretesting method: An evaluation of survey questionnaire via expert reviews technique. Asian Journal of Social Science Studies, 4(2), 1.

Nkundabakura, P., Nsengimana, T., Nyirahabimana, P., Nkurunziza, J.B., Mukamwambali, C., Dushimimana, J.C., Uwamariya, E., Batamuliza, J., Byukusenge, C., Nsabayezu, E. and Twahirwa, J.N., 2023. Usage of modernized tools and innovative methods in teaching and learning mathematics and sciences: A case of 10 districts in Rwanda. Education and Information Technologies, pp.1-22.

Oba-Adenuga, O. A., & Oba-Adenuga, M. A. (2018). Effectiveness of Ideation Creative Thinking Technique (ICTT) Training on Creative Problem-Solving Skills (CPSS) of

Teaching Personnel in Ogun State, Nigeria. West African Journal of Open and Flexible Learning, 6(2), 39-54.
Perry, K., Meissel, K., & Hill, M. F. (2022). Rebooting assessment. Exploring the challenges and benefits of shifting from pen-and-paper to computer in summative assessment. Educational Research Review, 36, 100451.
Rahmadi, I. F., & Lavicza, Z. (2021). Pedagogical Innovations in Elementary Mathematics Instructions: Future Learning and Research Directions. International Journal on Social and Education Sciences, 3(2), 360-378.
Tan, S. C., Chan, C., Bielaczyc, K., Ma, L., Scardamalia, M., & Bereiter, C. (2021). Knowledge building: Aligning education with needs for knowledge creation in the digital age. Educational Technology Research and Development, 1-24.
Trefil, J., & Hazen, R. M. (2016). The sciences: An integrated approach. John Wiley & Sons.
Ukah, Y., Ayewu, C., & Oworu, P. (2023). Improving Students' Language Learning through Project-Based Learning Activities. JELITA, 4(1), 9-23.
Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education–where are the educators?. International Journal of Educational Technology in Higher Education, 16(1), 1-27.