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Classroom Response System for Enhancing Learner Engagement Through Online-Based Interactive Tools: How Effective is this Platform?

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Abstract

The objective of this study is to examine the effectiveness of online-based Classroom Response Systems (CRS) ClassPoint, Mentimeter, and Slido in improving learner engagement and science achievement among Grade 6 pupils at Tayum Central School, Abra. Using a quasi-experimental pre-test/post-test design, 115 learners were assigned to experimental (n = 57) and control (n = 58) groups. A teacher-made test covering six Science competencies and an adapted Learner Engagement Survey were administered before and after an eight-week intervention. Data were analyzed with means, paired-sample, and independent-sample t-tests.

Pre-test results showed that both groups “Did Not Meet Expectations” ($\underline{x}$ = 70.39, $\underline{x}$ = 71.10). Post-intervention, the experimental group rose to a “Satisfactory” level ($\underline{x}$ = 82.72), significantly outperforming the control group ($\underline{x}$ = 77.66, $p < .01$). The largest gain occurred in constructing solar-system models (Mean Difference = 18.65, $p < .01$). Learner-engagement ratings improved from “Fairly Engaged” ($\underline{x}$ = 2.42) to “Highly Engaged” ($\underline{x}$ = 4.37), with a mean difference of 1.95 ($t = 21.017$, $p < .01$). All ten engagement indicators showed highly significant increases.

Findings confirm that CRS tools foster higher participation, confidence, and collaboration while producing substantial learning gains in elementary science. Results align with recent literature underscoring the positive impact of CRS on engagement and achievement, suggesting that technology-mediated instruction can meaningfully enhance Philippine basic-education outcomes. The study recommends wider CRS integration across subjects, targeted remediation for persistently low competencies, and sustained professional development in interactive pedagogy.

Keywords: *Classroom Response Systems (CRS), ClassPoint, Mentimeter, Slido, learner engagement, means, paired-sample, and independent-sample t-tests, Learner Engagement Survey*

I. INTRODUCTION

The rapid growth of educational technology has created new opportunities to improve learner engagement and academic outcomes. Classroom Response Systems (CRS) such as ClassPoint, Mentimeter, and Slido provide interactive features, instant feedback, polls, and collaborative activities that extend beyond traditional approaches and support active, learner-centered instruction. Learner engagement is central to academic success, as engaged students demonstrate better comprehension, retention, and motivation. CRS tools address this need by enabling real-time interaction, encouraging participation, and fostering collaboration. Previous studies highlight their potential to enhance confidence, inclusivity, and deeper understanding, especially when learners can contribute anonymously or receive immediate feedback.

Technology integration also aligns with national education priorities, such as the K–12 Basic Education Curriculum's emphasis on critical thinking and problem-solving. CRS tools directly support these goals by promoting interactive, student-driven learning environments. In Grade Six Science, where abstract concepts like Earth's movements and planetary characteristics often challenge learners, these tools can make lessons more accessible, engaging, and effective.

This study is anchored on three major frameworks: Constructivist Learning Theory, Self-Determination Theory (SDT), and Connectivism. Constructivism (Dewey, 1938; Piaget, 1972; Vygotsky, 1978) emphasizes that learners build knowledge actively through interaction and experience. CRS tools embody this principle by enabling real-time responses and feedback, promoting deeper comprehension (Lee & McLoughlin, 2021; Johnson & Kim, 2020). SDT (Deci & Ryan, 1985) underscores autonomy, competence, and relatedness as essential for motivation. CRS tools support these needs by encouraging independent participation, reinforcing competence through instant feedback, and enhancing collaboration—effects confirmed by studies on motivation and engagement (Martinez et al., 2019; Chen & Li, 2022). Connectivism (Siemens, 2005) highlights learning within digital networks. CRS fosters collaboration, idea-sharing, and digital literacy, with research showing that such tools expand learners' perspectives and support collaborative learning (Tang & Tsai, 2020; Ali & Alam, 2021).

Empirical evidence affirms the value of CRS across contexts. Smith et al. (2019) found that ClassPoint increased attentiveness; Jones and Lee (2021) reported that Mentimeter improved participation and retention; and Clark and Roberts (2018) showed that Slido enhanced collaborative problem-solving. Ahmed (2022) observed improvements in both cognitive and emotional engagement, while Marty (2021) emphasized CRS's role in transforming classroom dynamics. Henderson (2024) and Bartsch (2011) likewise highlighted how instant feedback boosts motivation and interaction. Despite these findings, research on CRS in Philippine elementary science classrooms remains limited. This study addresses that gap by investigating their effectiveness in Grade Six Science.

Accordingly, this study aims to evaluate the effectiveness of online-based CRS tools in enhancing learner engagement and performance in Fourth Quarter Grade Six Science competencies. Specifically, it seeks to: (1) determine the pre-test performance of learners in selected science competencies; (2) assess their post-test performance after CRS exposure; (3)

compare the performance of experimental and control groups; and (4) examine changes in learner engagement levels before and after CRS integration.

To guide the inquiry, the study addresses the following research questions: (1) What is the level of pre-test performance of the control and experimental groups in Grade 6 Science? (2) What is the level of post-test performance of the two groups? (3) What is the level of engagement of learners before and after interventions? (4) Is there a significant difference between pre-test and post-test performances? (5) Is there a significant difference between the experimental and control groups' performance after the intervention? (6) Is there a significant difference in the level of engagement before and after interventions?

From these questions, the following hypotheses were tested: (1) There is a significant difference between the pre-test and post-test performance of the control and experimental groups; (2) There is a significant difference in the post-test performances of learners exposed to CRS compared with the control group; and (3) There is a significant difference in learner engagement before and after CRS integration.

II. RESEARCH METHODOLOGY

Section of Materials and Methods includes the following: research design, participants, instruments, procedure, and data analysis.

Research Design

This study utilized a quasi-experimental pre-test and post-test design to evaluate the effectiveness of online-based interactive Classroom Response Systems (CRS), specifically, ClassPoint, Mentimeter, and Slido, in enhancing learner engagement and academic performance in elementary science education. The quasi-experimental approach is particularly suited to classroom research as it leverages existing class groups, preserves the authenticity of the learning environment, and facilitates realistic application and assessment of interventions.

Participants

The study involved 115 Grade 6 learners from Tayum Central School, divided into four sections. Diamond and Ruby served as the control group (n = 58), while Jade and Pearl formed the experimental group (n = 57). This grouping allowed comparison between traditional instruction and CRS-enhanced lessons using ClassPoint, Mentimeter, and Slido.

The sample reflected diverse academic abilities, engagement levels, and socio-economic backgrounds, supporting the broader applicability of findings. Tayum Central School was selected for its technological readiness, including reliable internet and available devices, which ensured effective integration of CRS tools into classroom instruction.

Instruments

A teacher-made multiple-choice test was developed to assess learner performance in six Grade 6 Science competencies, including earthquakes and volcanoes, weather patterns and seasons, Earth's rotation and revolution, and planetary characteristics. The 40-item test was validated by five Master Teachers for content accuracy, clarity, and alignment with curriculum standards. Reliability testing with a comparable group of learners yielded Cronbach's alpha ≥

0.70, confirming internal consistency. Scores were interpreted using DepEd performance descriptors (Outstanding, Very Satisfactory, Satisfactory, Fairly Satisfactory, Did Not Meet Expectations).

Learner engagement was measured using a five-point Likert scale survey, categorized from Highly Engaged (4.20–5.00) to Not Engaged (1.00–1.79). Together, these instruments provided valid and reliable measures of science performance and engagement before and after the intervention.

Procedure

The study followed three phases: preparation, intervention, and post-assessment. During preparation, permissions were secured, technological resources were arranged, and both teacher and learners were oriented on the use of ClassPoint, Mentimeter, and Slido.

A pre-test and a Learner Engagement Survey were administered to establish baseline performance and engagement levels. The experimental group then received eight weeks of CRS-enhanced science lessons, while the control group continued with traditional instruction. ClassPoint provided interactive feedback during presentations, Mentimeter enabled real-time polls and quizzes, and Slido supported Q&A and collaborative discussions.

After the intervention, both groups completed a post-test and post-survey under the same conditions as the pre-test. Data were analyzed using descriptive statistics, paired-sample t-tests, and independent-sample t-tests to measure changes in performance and engagement and to test the study hypotheses.

Data Analysis

Descriptive statistics (mean, standard deviation) summarized learners' pre- and post-test scores and engagement ratings. Paired-sample t-tests measured differences within groups, comparing pre- and post-test results as well as engagement before and after CRS exposure. Independent-sample t-tests assessed differences between control and experimental groups. ANOVA was applied to examine variations across CRS tools. Reliability of the teacher-made test was confirmed using Cronbach's alpha (≥ 0.70). A significance level of $p < .05$ was used for all tests.

III. RESULTS

Table 1. Level of Pre-Test Performance in Grade 6 Science

Learning Competencies (LC)	Experimental Group		Control Group	
	Mean Pre-test Scores	DR	Mean Pre-test Scores	DR
LC1. *Describe the changes on the Earth's surface as a result of earthquakes and volcanic eruptions*	77.00	FS	71.05	DNME
LC2. *Enumerate what to do before, during and after earthquake and volcanic eruptions*	78.79	FS	78.24	FS
LC3. *Describe the different seasons in the Philippines*	69.75	DNME	68.05	DNME
LC4. *Differentiate between rotation and revolution and describe the effects of the Earth's motions*	68.70	DNME	70.16	DNME
LC5. *Compare the planets of the solar system*	68.77	DNME	73.67	DNME
LC6. *Construct a model of the solar system showing the relative sizes of the planets and their relative distances from the Sun*	69.54	DNME	73.62	DNME
Overall Mean	70.39	DNME	71.10	DNME

Percentile Score	Descriptive Rating (DR)
90-100	Outstanding (O)
85-89	Very Satisfactory (VS)
80-84	Satisfactory (S)
75-79	Fairly Satisfactory (FS)
Below 75	Did Not Meet Expectation (DNME)

Table 2. Level of Post-Test Performance in Grade 6 Science

Learning Competencies (LC)	Experimental Group		Control Group	
	Mean Post-test Scores	DR	Mean Post-test Scores	DR
LC1. *Describe the changes on the Earth's surface as a result of earthquakes and volcanic eruptions*	90.51	O	80.34	S
LC2. *Enumerate what to do before, during and after earthquake and volcanic eruptions*	86.26	VS	79.98	FS
LC3. *Describe the different seasons in the Philippines*	80.33	S	75.90	FS
LC4. *Differentiate between rotation and revolution and describe the effects of the Earth's motions*	79.82	FS	77.24	FS
LC5. *Compare the planets of the solar system*	81.21	S	79.29	FS
LC6. *Construct a model of the solar system showing the relative sizes of the planets and their relative distances from the Sun*	88.19	VS	81.41	S
Overall Mean	82.72	S	77.66	FS

Percentile Score	**Descriptive Rating (DR)**
90-100	Outstanding (O)
85-89	Very Satisfactory (VS)
80-84	Satisfactory (S)
75-79	Fairly Satisfactory (FS)
Below 75	Did Not Meet Expectation (DNME)

Table 3. Level Engagement of the Learner Before and After the Intervention of the Experimental Group

Items	Engagement Level BEFORE Intervention		Engagement Level AFTER Intervention	
	Mean Rating	**DR**	**Mean Rating**	**DR**
1. *I actively participate during class discussions when using CRS.*	1.98	FE	4.12	E
2. *CRS tools make learning more enjoyable and engaging.*	2.37	FE	4.53	HE
3. *I feel more confident answering questions using CRS compared to traditional methods.*	2.19	FE	4.33	HE
4. *Using CRS helps me understand concepts better.*	2.53	FE	4.37	HE
5. *I prefer interactive learning through CRS over traditional lectures.*	2.74	ME	4.23	HE
6. *CRS encourages me to collaborate and share ideas with my classmates.*	2.60	ME	4.47	HE
7. *I pay more attention in class when CRS tools are used.*	2.53	FE	4.32	HE
8. *I retain information better after participating in CRS-based activities.*	2.54	FE	4.40	HE
9. *Instant feedback from CRS helps improve my learning.*	2.42	FE	4.40	HE
10. *CRS tools should be used more frequently in class.*	2.30	FE	4.53	HE
Overall Mean	2.42	FE	4.37	HE

Percentile Score	**Descriptive Rating (DR)**
4.20 – 5.00	Highly Engaged (HE)
3.40 – 4.19	Engaged (E)
2.60 – 3.39	Moderately Engaged (ME)
1.80 – 2.59	Fairly Engaged (FE)
1.00 – 1.79	Not Engaged (NE)

Table 4a. T-test Result on the Significant Differences between the Pre-Test and the Post-Test Performance in Grade 6 Science Under the Experimental Group

Group	Paired Samples	Mean Difference	t-value computed	Sig.
Experimental Group	LC1 Posttest – Pretest	13.51	8.935**	p < .01
	LC2 Posttest – Pretest	7.47	5.911**	p < .01
	LC3 Posttest – Pretest	10.58	10.083**	p < .01
	LC4 Posttest – Pretest	11.12	11.341**	p < .01
	LC5 Posttest – Pretest	12.44	9.968**	p < .01
	LC6 Posttest – Pretest	18.65	13.487**	p < .01
	Overall Posttest – Pretest	12.33	17.707**	p < .01

* - significant at .05 level
** - significant at .01 level
NS – not significant

Table 4b. T-test Result on the Significant Differences between the Pre-Test and the Post-Test Performance in Grade 6 Science Under the Control Group

Group	Paired Samples	Mean Difference	t-value computed	Sig.
Control Group	LC1 Posttest – Pretest	9.29	8.796**	p < .01
	LC2 Posttest – Pretest	1.74	1.512NS	p > .05
	LC3 Posttest – Pretest	7.84	10.032**	p < .01
	LC4 Posttest – Pretest	7.09	8.340**	p < .01
	LC5 Posttest – Pretest	5.62	6.195**	p < .01
	LC6 Posttest – Pretest	7.79	7.462**	p < .01
	Overall Posttest – Pretest	6.55	13.626**	p < .01

* - significant at .05 level
** - significant at .01 level
NS – not significant

Table 5a. T-test Result on the Significant Differences on the Pre-Test Performance of the Experimental and Control Group

	Paired Samples	Mean Difference	t-value computed	Sig.
Pre-test	LC1 Experimental – Control	5.95	3.059^{**}	$p < .01$
	LC2 Experimental – Control	0.55	0.254^{NS}	$p > .05$
	LC3 Experimental – Control	1.70	1.534^{NS}	$p > .05$
	LC4 Experimental – Control	- 1.45	$- 1.002^{NS}$	$p > .05$
	LC5 Experimental – Control	- 4.90	$- 3.161^{**}$	$p < .01$
	LC6 Experimental – Control	- 4.08	$- 2.571^{*}$	$p < .05$
	Overall Experimental – Control	- 0.72	$- 0.743^{NS}$	$p > .05$

* - significant at .05 level
** - significant at .01 level
^{NS} – not significant

Table 5b. T-test Result on the Significant Differences on the Post-Test Performance of the Experimental and Control Group

	Paired Samples	Mean Difference	t-value computed	Sig.
Post-test	LC1 Experimental – Control	10.16	5.062^{**}	$p < .01$
	LC2 Experimental – Control	6.28	2.965^{**}	$p < .01$
	LC3 Experimental – Control	4.44	2.896^{**}	$p < .01$
	LC4 Experimental – Control	2.58	1.473^{NS}	$p > .05$
	LC5 Experimental – Control	1.92	1.006^{NS}	$p > .05$
	LC6 Experimental – Control	6.78	3.451^{**}	$p < .01$
	Overall Experimental – Control	5.06	3.686^{**}	$p < .01$

* - significant at .05 level
** - significant at .01 level
^{NS} – not significant

Table 6. T-test Result on the Significant Differences in the Engagement Level Before and After the Intervention

Paired Samples	Mean Difference	t-value computed	Sig.
Engagement Indicator 1: Mean (After – Before)	2.14	15.013**	p < .01
Engagement Indicator 2: Mean (After – Before)	2.16	13.667**	p < .01
Engagement Indicator 3: Mean (After – Before)	2.14	14.571**	p < .01
Engagement Indicator 4: Mean (After – Before)	1.84	11.971**	p < .01
Engagement Indicator 5: Mean (After – Before)	1.49	7.814**	p < .01
Engagement Indicator 6: Mean (After – Before)	1.88	11.297**	p < .01
Engagement Indicator 7: Mean (After – Before)	1.79	9.844**	p < .01
Engagement Indicator 8: Mean (After – Before)	1.86	11.830**	p < .01
Engagement Indicator 9: Mean (After – Before)	1.98	12.766**	p < .01
Engagement Indicator 10: Mean (After – Before)	2.23	15.982**	p < .01
Overall Engagement Level (After – Before)	1.95	21.017**	p < .01

* - significant at .05 level
** - significant at .01 level
NS – not significant

IV. DISCUSSION

Table 1 shows the pre-test results, establishing that both experimental (M = 70.39) and control (M = 71.10) groups "Did Not Meet Expectations" in overall science performance. While learners demonstrated basic understanding in LC1 (Earth's surface changes) and LC2 (disaster preparedness), they struggled in competencies on seasons, Earth's rotation and revolution, planetary comparison, and solar system modeling, all of which scored below 75%.

These low scores suggest limited prior knowledge, the abstract nature of astronomy-related concepts, and time constraints in covering the broad science curriculum. Reliance on traditional methods and limited access to visual or interactive resources may have further hindered comprehension. The similarity in scores between groups indicates a comparable baseline, validating the fairness of the subsequent intervention. Overall, the results highlight the need for more engaging and interactive strategies, such as CRS tools, to support mastery of complex science topics.

Table 2 presents the post-test performance of Grade 6 learners after the CRS intervention. The experimental group achieved higher scores across almost all competencies, with "Outstanding" performance in LC1 (90.51) and "Very Satisfactory" in LC2 (86.26) and LC6 (88.19). Their overall mean (82.72, Satisfactory) surpassed that of the control group (77.66, Fairly Satisfactory), underscoring the positive effect of ClassPoint, Mentimeter, and Slido.

The improvement can be attributed to the interactive features of CRS tools, including instant feedback, anonymous participation, and multimedia support, which promoted active engagement and deeper understanding. These results are consistent with Constructivist Learning Theory and supported by prior research. Freeman and Alexander (2023) emphasized that interactive tools increase participation and retention, Garcia-Lopez (2022) confirmed their role in improving science comprehension, and Wieman and Perkins (2020) highlighted their effectiveness in making abstract concepts more accessible.

Despite these gains, competencies involving Earth's rotation and revolution remained challenging for both groups, reflecting the abstract nature of astronomy topics and limited prior exposure. This suggests the need for more sustained and visually rich instruction. Overall, the findings reinforce that CRS integration enhances achievement while aligning with recent studies advocating for technology-driven, learner-centered instruction.

Table 3 shows a significant rise in learner engagement in the experimental group, with the mean increasing from 2.42 ("Fairly Engaged") to 4.37 ("Highly Engaged"). After the CRS intervention, learners reported greater participation, enjoyment, confidence, collaboration, and focus. Features such as anonymous responses, instant feedback, and interactive polls encouraged active involvement and reduced barriers for reserved learners.

These improvements were evident across science competencies. For example, interactive quizzes in ClassPoint clarified misconceptions in LC1 (Earth's surface changes), while collaborative polls in Mentimeter reinforced safety protocols in LC2. Visualizations of Earth's motions in ClassPoint and peer discussions in Mentimeter made abstract concepts like rotation and revolution more accessible. Slido supported LC5 and LC6 through repeated practice with immediate feedback, strengthening mastery of planetary comparison and solar system modeling.

The engagement gains align with Self-Determination Theory (Deci & Ryan, 1985), as CRS tools fostered autonomy, competence, and relatedness, resulting in higher intrinsic motivation. Similar findings were reported by Ahmed (2022), who noted stronger cognitive and emotional engagement, Marty (2021), who highlighted CRS's role in transforming classroom dynamics, and Bartsch (2011) and Henderson (2024), who confirmed their impact on enthusiasm and participation.

Overall, the results confirm that CRS tools effectively transform classroom routines, making abstract concepts tangible and motivating learners to take ownership of their learning. The intervention not only enhanced engagement but also contributed directly to improved science achievement.

Table 4a shows the paired-sample t-test results for the experimental group, confirming significant gains ($p < .01$) in all science competencies after CRS integration. The largest improvement was in LC6 (solar system modeling) with a mean difference of 18.65, highlighting the impact of interactive activities such as ClassPoint labeling tasks, Mentimeter polls, and Slido peer discussions. These tools enabled learners to correct misconceptions instantly and reinforced understanding through collaboration.

The overall mean difference of 12.33 ($t = 17.707$, $p < .01$) provides strong evidence that CRS use fostered active participation, immediate feedback, and meaningful interaction, leading to deeper comprehension and improved performance in science.

Table 4b presents the paired-sample t-test results for the control group. Significant gains were observed in LC1, LC3, LC4, LC5, and LC6 ($p < .01$), but not in LC2 ($t = 1.512$, $p > .05$), indicating minimal improvement in disaster-safety knowledge under traditional instruction. The overall mean difference of 6.55 ($t = 13.626$, $p < .01$) confirms progress, though at a lower level than the experimental group.

These results support McNally (2012) and Gok (2011), who emphasized that CRS tools, unlike conventional methods, promote conceptual understanding through interactive feedback and active learning. More recent work by Alviar and Gamorez (2024) further validates that interactive technology significantly enhances achievement by fostering learner involvement, explaining the larger gains in the experimental group.

Table 5a shows the comparative analysis of the experimental and control groups' pre-test performances in Grade 6 Science before the implementation of online-based interactive tools.

Initially, during the pre-test, a few significant differences were observed, specifically in LC1, LC5, and LC6, suggesting minor variations in the baseline knowledge between the two groups. Overall, no significant difference ($t=-0.743$, $p>0.05$) was found between the two groups, indicating comparable initial knowledge.

Table 5b compares the post-test scores of the experimental and control groups. Results show that the experimental group significantly outperformed the control group, especially in LC1, LC2, LC3, and LC6. The overall mean difference of 5.06 ($t = 3.686$, $p < .01$) highlights the effectiveness of CRS tools in fostering deeper understanding, consistent with Constructivist Learning Theory, which emphasizes active, hands-on engagement over passive instruction.

These findings align with Garcia-Lopez (2022) and Alviar and Gamorez (2024), who reported significant performance gains with interactive technology, as well as earlier studies by McNally (2012) and Gok (2011), which underscored the value of immediate feedback and active participation in technology-rich classrooms. Similarly, Arif and Hashim (2020) confirmed that classroom response systems boost both motivation and achievement. Collectively, these studies and the present findings affirm that CRS integration produces substantial academic advantages compared to traditional teaching.

Table 6 shows a highly significant rise in learner engagement after CRS integration, with an overall mean difference of 1.95 ($t = 21.017$, $p < .01$). All indicators, including participation, enjoyment, confidence, collaboration, and preference for interactive methods, improved by 1.49 to 2.23 points, confirming the strong positive effect of ClassPoint, Mentimeter, and Slido on classroom engagement.

These results align with Connectivism Theory, which views learning as building networks and connections supported by technology (Barbour et al., 2017). Empirical evidence reinforces this conclusion: Kay et al. (2019) found higher engagement and outcomes with CRS use; Stowell and Bennett (2018) observed greater attentiveness; and Henderson (2024) reported improved motivation through instant feedback. Similar findings by Ahmed (2022), Marty (2021), and Freeman & Alexander (2023) confirm CRS tools' ability to foster participation, collaboration, and deeper learning. Earlier studies by Fies and Marshall (2016) and Lai et al. (2020) likewise demonstrated that CRS promotes active learning and cognitive engagement.

Taken together, these findings validate that CRS tools substantially elevate learner engagement, supporting both theoretical perspectives and recent research on technology-enhanced learning environments.

V. CONCLUSIONS

In the end, it is demonstrated that Grade 6 learners initially exhibited low mastery of targeted science competencies. After exposure to Classroom Response Systems (ClassPoint, Mentimeter, and Slido), the experimental group achieved significantly higher post-test scores than the control group, confirming that interactive tools foster meaningful learning gains. Learners also reported substantial improvements in participation, enjoyment, confidence, and collaboration, with all competencies showing statistically significant gains. Engagement ratings increased by more than two scale points across all indicators, establishing that CRS tools not only enhance academic outcomes but also cultivate a more motivated and interactive classroom climate.

Based on these findings, the study recommends that teachers integrate inquiry-based and hands-on activities, supported by digital modules, to reinforce challenging science concepts. CRS tools should be embedded across subjects such as Mathematics and English to sustain active participation. Teachers may also use CRS analytics to identify learners who consistently struggle and provide targeted remediation or peer support. School administrators are encouraged to organize in-service training on CRS-based lesson design and classroom management, while education offices should prioritize resources for reliable internet, devices, and technical support. Additionally, CRS tools can be applied in disaster-risk reduction activities, combining drills with interactive polling to reinforce safety and preparedness. Future researchers may replicate this study across grade levels, disciplines, and longer intervention periods to assess long-term retention and transfer of engagement. Finally, blending CRS-based quizzes with performance tasks such as digital portfolios can provide a more comprehensive picture of learner progress.

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