Reducing Science Anxiety Using Kahoot Mobile App in Teaching Physical Science

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ABSTRACT

This study investigated the impact of the use of Kahoot mobile application on students' science-related anxiety and validated the quality of developed lesson plans across multiple dimensions. It (1) determined the level of science anxiety of students before and after the intervention, (2) developed and validated lessons in Physical Science, integrating Kahoot mobile application, (3) tested the effectiveness of the intervention in reducing the level of science anxiety of the students, 4) described the experiences of the students on the intervention, and lastly, (5) proposed enhanced lesson exemplars on Physical Science, integrating Kahoot mobile application. A total of 27 students participated, with their anxiety levels measured before and after the intervention using indicators of general feelings toward science, performance anxiety, and communication anxiety. Lesson plans (DLP1–DLP5) were evaluated by three expert validators for manuscript quality, content, language use, illustrative materials, and social sensitivity. Findings revealed that students' anxiety decreased significantly across all domains. General feelings toward science improved modestly, performance anxiety, particularly in public problem-solving, and communication anxiety in oral presentations and written reports also declined. However, reverse-scored items indicated that confidence and enjoyment in science did not improve proportionally, suggesting that anxiety reduction alone does not guarantee increased motivation or positive affect. Lesson validation results demonstrated that the materials were largely free from conceptual, factual, computational, and language errors, with only minor typographical issues noted. Content was clear, scaffolded, and provided opportunities for feedback, though integration of local contexts was inconsistent. Language use was appropriate, but academic vocabulary lacked contextualization. Illustrative materials were consistently age-appropriate and technically sound, while social content was free from bias, discrimination, and inappropriate references. Overall, the study concludes that validated lesson plans paired with targeted interventions can effectively reduce science-related anxiety.

Keyword: *Kahoot mobile application, science anxiety, physical science education, gamification*

1. INTRODUCTION

Science anxiety is a specific form of academic anxiety characterized by apprehension, tension, and fear when engaging with science-related tasks. Mallow (2006) emphasized that science anxiety is not merely a dislike of science but a debilitating emotional response rooted in negative experiences, perceived difficulty, and low self-efficacy. Empirical studies have documented the prevalence and consequences of science anxiety. Udo et al. (2004) found that science anxiety significantly affects student participation and achievement, with notable differences across gender groups. More recent explorations, such as the work of Dela Cruz and Lapinid (2021), highlight that science anxiety arises from multiple factors, including attitudes toward science, interactions with assessments, classroom activities, and the overall learning environment.

Science is a difficult subject because of its abstract and complex ideas. This is why science teachers have to innovate the teaching-learning processes by introducing innovative instructional materials (Candia et al., 2025; Arevalo et al., 2023; Labayandoy & Janer, 2025; Espejon & Janer, 2022; Foraque & Janer, 2024). In addition, gamification has been used to make science instruction more engaging and to ensure students' active participation (Lasala, 2022). Gamification refers to the application of game design elements in non-game contexts, particularly in education, to enhance motivation, engagement, and learning outcomes (Lasala, 2023). According to Deterding et al. (2011), gamification involves incorporating features such as points, badges, leaderboards, and challenges into learning environments to foster active participation. In the classroom, gamification has been shown to reduce anxiety by transforming stressful tasks into enjoyable experiences, thereby increasing student confidence and persistence (Lasala, 2024a; Hamari et al. 2014). Research further suggests that gamification promotes intrinsic

motivation by satisfying learners' psychological needs for competence, autonomy, and relatedness, as outlined in self-determination theory (Lasala, 2024b; Deci & Ryan, 2000).

The integration of Kahoot into Physical Science instruction provides a dynamic approach to teaching abstract and often anxiety-inducing concepts. By embedding Kahoot quizzes into lesson delivery, teachers can transform traditional lectures into interactive experiences that encourage active participation and immediate feedback (Cankaya & Karamete, 2009). Kahoot's competitive yet collaborative format fosters a supportive classroom environment where students feel motivated to engage without the fear of failure, thereby reducing anxiety associated with science learning (Wang & Tahir, 2020).

In Physical Science, where topics such as motion, energy, and atomic structure can be challenging, Kahoot serves as a formative assessment tool that allows teachers to identify misconceptions in real time and adjust instruction accordingly (Licorish et al. 2018). Moreover, the platform's accessibility through mobile devices ensures inclusivity, enabling students to participate regardless of technological background. Studies have shown that integrating Kahoot into science lessons not only improves retention and comprehension but also enhances classroom management by sustaining student attention and minimizing disruptive behaviors (Bicen & Kocakoyun, 2018). Thus, Kahoot's integration into Physical Science teaching represents a pedagogical strategy that simultaneously addresses cognitive and affective barriers, making science learning more engaging and less intimidating.

This study is focused on five objectives:

(1) determine the level of science anxiety of students before and after the intervention,
(2) develop and validate lessons in Physical Science, integrating Kahoot mobile application,
(3) test the effectiveness of the intervention in reducing the level of science anxiety of the students,
(4) describe the experiences of the students on the intervention, and lastly,
(5) propose enhanced lesson exemplars on Physical Science, integrating Kahoot mobile application.

2. METHODS

This study utilized a quasi-experimental one-group pretest–posttest design combined with a mixed-method validation approach. It employed a purposive sampling technique with 27 participants from the Grade 11 Senior High School students enrolled in Physical Science classes during the second semester of the academic year 2025-2026 at Talaonga National High School who exhibited high levels of science anxiety based on their scores in the Science Anxiety Questionnaire.

A qualitative interview and a reflective journal were also utilized to let the researcher know their comments and experiences regarding the integration of Kahoot.

For the validation of the lesson plans, a pool of three experts was selected. All of the validators were from the Sorsogon Province who were carefully selected to ensure the quality of the lesson plans. In addition, during the implementation, two Science teachers were invited to observe and give comments about the integration. The data were analyzed using weighted mean, Wilcoxon signed-rank test and effect size.

3. RESULTS AND DISCUSSIONS

The intervention showed a significant impact on reducing anxiety levels. Quantitative analysis of the SAQ pretest and posttest results indicated that students' anxiety decreased across all measured domains.

As shown in Chart 1, students generally reported moderate anxiety (MA) toward science prior to the intervention (M = 3.30). The most pronounced concern was test-related anxiety, with "I worry about failing science tests" rated at M = 4.30 (HA), indicating that assessments were a major source of stress. Other indicators, such as nervousness in learning new concepts (M = 3.41, MA) and anxiety during science classes (M = 3.33, MA), also reflected moderate levels of apprehension. Reverse-scored items, including confidence in experiments (M = 2.93, MA) and enjoyment of learning science (M = 2.59, MA), suggested that students' positive feelings toward science were relatively low even before the intervention.

Indicators (n = 27)	Before the Intervention		After the Intervention	
	Mean	Interpretation	Mean	Interpretation
1. I feel nervous when I have to learn new science concepts.	3.41	MA	3.11	MA
2. Science classes make me feel anxious.	3.33	MA	2.70	MA
3. I worry about failing science tests.	4.30	HA	3.59	HA
4. I feel confident when doing science experiments (RS).	2.93	MA	2.81	MA
5. I enjoy learning science (RS).	2.59	MA	2.19	HA
6. I feel overwhelmed by the amount of information in science subjects.	3.26	MA	3.11	MA
Overall Mean	**3.30**	**MA**	**2.92**	**MA**

Legend: HA – high anxiety, MA – moderate anxiety, RS - reverse scored

Chart 1 – General Feelings Toward Science

Chart 2 presents the students' performance-related anxiety before and after the intervention. Prior to the intervention, the overall mean score was 3.61, interpreted as high anxiety (HA). The strongest indicator was students' tension when asked to solve science problems in front of others (M = 4.33, HA), highlighting the social dimension of performance anxiety. Other indicators such as anxiety before exams (M = 3.67, HA) and worry about not understanding lectures (M = 3.96, HA) also reflected elevated anxiety levels, suggesting that both evaluative and comprehension-related contexts were major sources of stress.

Indicators (n = 27)	Before the Intervention		After the Intervention	
	Mean	Interpretation	Mean	Interpretation
1. I get anxious before a science exam.	3.67	HA	3.30	MA
2. I feel tense when asked to solve science problems in front of others.	4.33	HA	3.30	MA
3. I worry that I won't understand science lectures.	3.96	HA	3.44	MA
4. I feel calm during science assessments (RS).	3.37	MA	2.85	MA
5. I avoid science courses because they make me anxious.	3.15	MA	2.59	MA
6. I feel confident when answering science questions (RS).	3.19	MA	2.93	MA
Overall Mean	**3.61**	**HA**	**3.07**	**MA**

***Lege**nd: VHA – Very high anxiety, HA – high anxiety, MA – moderate anxiety, RS - reverse scored*

Chart 2 - Students' Science Performance Anxiety

Chart 3 illustrates the students' communication-related anxiety before and after the intervention. Initially, the overall mean score was 3.55, interpreted as *high anxiety (HA)*. The most stressful indicators were exam preparation (M = 4.19, HA), writing science reports (M = 3.96, HA), and presenting science topics (M = 3.78, HA). These results suggest that evaluative and expressive tasks—particularly those requiring demonstration of knowledge in written or oral form—were the primary sources of communication anxiety.

After the intervention, the overall mean decreased to 3.14 (MA), indicating a shift from *high* to *moderate anxiety*. Most items showed reductions, reflecting the intervention's effectiveness in easing communication-related stress. For example, stress during exam preparation declined from 4.19 (HA) to 3.19 (MA), while nervousness in presentations dropped from 3.78 (HA) to 3.26 (MA). Avoidance of science fairs or competitions also lessened, decreasing from 3.48 (MA) to 3.07 (MA), suggesting that students became more willing to engage in public science-related activities. Similarly, hesitation to share ideas in discussions improved from 3.63 (HA) to 3.22 (MA), pointing to greater openness in classroom communication.

Indicators (n = 27)	Before the Intervention		After the Intervention	
	Mean	Interpretation	Mean	Interpretation
1. I feel stressed when I have to study for science exams.	4.19	HA	3.19	MA

2.	I find science topics confusing and hard to follow.	3.44	MA	2.81	MA
3.	I feel discouraged when I don't understand science concepts quickly.	3.04	MA	3.22	MA
4.	I feel anxious when I receive science homework.	3.37	MA	2.93	MA
5.	I worry about being compared to others in science class.	3.37	MA	3.33	MA
6.	I feel pressure to perform well in science even if I don't enjoy it.	3.56	HA	3.00	MA
7.	I feel nervous when I have to present science topics.	3.78	HA	3.26	MA
8.	I get anxious when participating in science group discussions.	3.22	MA	3.07	MA
9.	I feel comfortable explaining science concepts to others (RS).	3.78	LA	3.22	MA
10.	I avoid asking questions in science class because I fear looking foolish.	3.52	HA	3.00	MA
11.	I hesitate to share my ideas in science discussions.	3.41	MA	3.22	MA
12.	I feel nervous when asked to write science reports.	3.96	HA	3.48	MA
13.	I avoid participating in science fairs or competitions due to anxiety.	3.48	MA	3.07	MA
Overall Mean		**3.55**	**HA**	**3.14**	**MA**

**Reversed scored*

Chart 3 - Students' Science Communication Anxiety

Chart 4 presents the results of expert validation for the five developed Daily Lesson Plan (DLP) manuscripts. Across all five lessons, validators consistently confirmed that the manuscripts were free from conceptual, factual, computational, language, and plagiarized content errors, with most indicators receiving a score of 3 (Y) across evaluators. This outcome demonstrates strong manuscript quality and reflects the rigor of the lesson development process. The absence of major errors suggests that the lessons were pedagogically sound, scientifically accurate, and linguistically appropriate for classroom use.

Indicators (n = 3)	DLP1		DLP2		DLP3		DLP4		DLP5	
The DLP Manuscript is free from:	Y	N	Y	N	Y	N	Y	N	Y	N
1. Conceptual errors	3	0	3	0	3	0	3	0	3	0
2. Factual errors	3	0	3	0	3	0	3	0	3	0
3. Computational errors	3	0	3	0	3	0	3	0	3	0
4. Language errors	3	0	3	0	3	0	3	0	3	0
5. Typographical errors	2	1	3	0	2	1	3	0	3	0
6. Plagiarized content	3	0	3	0	3	0	3	0	3	0

Chart 4 - Validation of Lessons Along with DLP Manuscript

Chart 5 presents the validators' evaluations of the lesson content across eight indicators. Results show that all five Daily Lesson Plans (DLPs) were consistently validated as having clear learning objectives, well-identified target learners, structured content that scaffolds learning, opportunities for feedback, and appropriate language use. Each of these indicators received unanimous agreement from validators (3 "Y" scores per lesson), underscoring the strong alignment of the lessons with instructional design principles. The presence of explicit objectives and structured scaffolding suggests that the lessons were pedagogically coherent and accessible to learners, while the appropriateness of language indicates sensitivity to the intended audience.

Additionally, validators confirmed that the lessons clearly identified pre-requisite knowledge and skills, established connections to prior and future learning, and provided clear instructions for use. These features are critical for ensuring continuity in science education and supporting learners' progression across topics. The validation outcomes therefore affirm that the lessons were not only accurate but also practical and user-friendly.

Indicators	DLP1		DLP2		DLP3		DLP4		DLP5	
(n = 3)	Y	N	Y	N	Y	N	Y	N	Y	N

1.	Learning objectives are made explicit to learners/users.	3	0	3	0	3	0	3	0	3	0
2.	The target learners/users are clearly identified.	3	0	3	0	3	0	3	0	3	0
3.	Content is structured to scaffold learning.	3	0	3	0	3	0	3	0	3	0
4.	Provides an opportunity for learners/users to obtain feedback either within or outside the resource.	3	0	3	0	3	0	3	0	3	0
5.	Pre-requisite knowledge/skills are clearly identified, and their connections to prior and future learning are established.	3	0	3	0	3	0	3	0	3	0
6.	Is easy to use and the language is appropriate for the intended learner/user.	3	0	3	0	3	0	3	0	3	0
7.	Clear instructions for use are provided.	3	0	3	0	3	0	3	0	3	0
8.	Lessons integrate/use local information, materials and contexts.	2	1	3	0	3	0	3	0	3	0

Chart 5 - Validation of Lessons Along with DLP Content

Chart 6 presents the validators' assessments of the language used in the five Daily Lesson Plan (DLP) manuscripts. Overall, the results indicate that the lessons demonstrated strong language quality. Validators unanimously confirmed that statements and phrases made sense, sentences contributed to a unified idea, and logical sequencing was consistently observed. Similarly, spelling, punctuation, capitalization, and hyphenation were all applied correctly across the manuscripts. These findings suggest that the lessons were linguistically coherent, grammatically accurate, and accessible to learners.

The evaluations also affirmed that the choice of words and vocabulary was appropriate for the intended learners, with sentence length judged suitable for comprehension. Transitional phrases and conjunctions were generally used effectively to link ideas, though one minor issue was noted in DLP1, where transitional phrasing received slightly lower ratings (2 "Y", 1 "N"). This suggests that while cohesion was strong overall, occasional improvements in linking sentences could enhance clarity further.

A consistent limitation was observed across all five lessons in relation to academic vocabulary contextualization. Validators indicated that academic language and content-specific terms were not adequately contextualized or translated (1 "Y", 2 "N" across all DLPs). This finding highlights a critical area for improvement, as contextualizing technical vocabulary is essential for ensuring that learners can meaningfully engage with scientific concepts. Without sufficient contextualization, students may struggle to connect abstract terminology to real-world applications, potentially limiting comprehension and retention.

Indicators (n = 3)		DLP1		DLP2		DLP3		DLP4		DLP5	
		Y	N	Y	N	Y	N	Y	N	Y	N
1.	The statements/phrases make sense.	3	0	3	0	3	0	3	0	3	0
2.	The sentences in the paragraph contribute to one idea.	3	0	3	0	3	0	3	0	3	0
3.	Conjunctions and transitional phrases are used to link sentences or paragraphs.	2	1	3	0	3	0	3	0	3	0
4.	The length of sentences is suitable for the learners.	3	0	3	0	3	0	3	0	3	0
5.	Choice of words/expressions is appropriate.	3	0	3	0	3	0	3	0	3	0
6.	Vocabulary is suitable for the learners.	3	0	3	0	3	0	3	0	3	0
7.	Academic language/content area vocabulary are not contextualized or translated	2	1	2	1	2	1	2	1	2	1
8.	Words are correctly spelled.	3	0	3	0	3	0	3	0	3	0
9.	The correct tense is applied, and the correct person perspective is observed throughout the learning resource.	3	0	3	0	3	0	3	0	3	0
10.	Punctuations are in the right places.	3	0	3	0	3	0	3	0	3	0
11.	Rules on capitalization and hyphenation are followed.	3	0	3	0	3	0	3	0	3	0
12.	Thoughts/ideas are logically sequenced.	3	0	3	0	3	0	3	0	3	0

13. Headings or titles are appropriate to the content.	3	0	3	0	3	0	3	0	3	0

Chart 6 - Validation of Lessons Along with the Use of Language

Chart 7 presents the validators' assessments of the illustrative materials used in the five Daily Lesson Plan (DLP) manuscripts. Results show unanimous agreement across all validators that the materials were appropriate to the age, context, setting, and experience of the target learners. Each DLP received full validation (3 "Y" scores per lesson) for this indicator, confirming that the illustrations were pedagogically suitable and aligned with learners' developmental levels. This finding underscores the importance of age-appropriate visual aids in supporting comprehension and engagement in science lessons.

Indicators (n = 3)	DLP1		DLP2		DLP3		DLP4		DLP5	
	Y	N	Y	N	Y	N	Y	N	Y	N
1. Illustrative materials are appropriate to the age, context, setting, and experience of the target learners.	3	0	3	0	3	0	3	0	3	0
2. There are no pixelated illustrative materials.	3	0	3	0	3	0	3	0	3	0

Chart 7 - Validation of Lessons Along with Illustrative Materials

The absence of gender bias and discriminatory content reflects the lessons' commitment to equity and inclusivity, ensuring that all learners are represented fairly and respectfully. Similarly, the exclusion of foreign or branded products and inappropriate references to Indigenous Peoples' culture demonstrates sensitivity to cultural authenticity and the avoidance of commercial influence in educational contexts. Validators also confirmed that illustrative materials and textual content were socially appropriate, reinforcing the integrity of the lessons as unbiased and learner-centered resources.

Indicators (n = 3)	DLP1		DLP2		DLP3		DLP4		DLP5	
The DLP is free from:	Y	N	Y	N	Y	N	Y	N	Y	N
1. social content errors in text and illustrative materials.	3	0	3	0	3	0	3	0	3	0
2. gender bias	3	0	3	0	3	0	3	0	3	0
3. use of foreign or branded products	3	0	3	0	3	0	3	0	3	0
4. use of materials involving aspects of IP culture	3	0	3	0	3	0	3	0	3	0
5. use of materials with discrimination of person with disability	3	0	3	0	3	0	3	0	3	0
6. representation of public servants	3	0	3	0	3	0	3	0	3	0

Chart 8 - Validation of Lessons Along with Social Content

General Feelings Towards Science. The results in Table 9 indicated a statistically significant difference in anxiety scores as revealed by the Wilcoxon value of 15.50 and a p-value of 0.000079, which is less than the 0.05 level of significance. Hence, the null hypothesis was rejected. There is a significant difference between the students' level of science anxiety before and after the intervention. The effect size for this intervention was also large (r = 0.79), demonstrating that it had a substantial impact in reducing science-related anxiety.

Science Performance Anxiety. As for science performance anxiety, the computed W value was 7.00 with a p-value of 0.00007 and an effect size of $r = 0.83$, leading to the rejection of the null hypothesis. This indicates that the integration of enhanced lesson exemplars, particularly with Kahoot, substantially lowered students' apprehension when demonstrating their knowledge and skills in science-related tasks. The strong effect size suggests that the intervention was highly effective in building confidence and reducing stress during performance-based activities.

Science Communication Anxiety. The results for science communication anxiety showed that the computed W value was 6.50, a p-value of 0.00002843 with an effect size of $r = 0.84$, also resulting in the rejection of the null hypothesis. This demonstrates that the intervention significantly improved students' comfort in expressing scientific ideas, whether in oral discussions or collaborative exchanges. The high effect size underscores that Kahoot's interactive and supportive environment encouraged students to communicate more openly, thereby reducing fear of judgment or error.

Statistical Bases	General Feeling Toward Science	Science Performance Anxiety	Science Communication Anxiety
Computed W	15.50	7.00	6.50
p-value	0.000079	0.00007	0.00002843
Effect size (r)	0.79	0.83	0.84
Decision on H_0	Reject	Reject	Reject
Conclusion	Significant	Significant	Significant

Chart 9 - Effectiveness of the Intervention

Students' Experiences on the Intervention Used

Students consistently reported positive experiences with the integration of Kahoot in our Physical Science classes. The interactive platform fostered enthusiasm and engagement, transforming lessons into dynamic sessions characterized by enjoyment and active participation, even my student who is very quiet in class during traditional methods, was very active. They highlighted the game-like structure, colorful visuals, and immediate feedback as elements that reduced anxiety and encouraged confidence in answering questions. The competitive yet collaborative environment promoted motivation, while the sense of fun made complex scientific concepts more approachable. Kahoot does not only contributed to a classroom atmosphere where learning was not only effective but also memorable and enjoyable. As stated in student 5 reflective journal,

"Learning science is getting better in having new ways to learn, like a game, like this Kahoot application. Pen and paper are boring, experiments or lab works are difficult, while Kahoot? It's fun while learning. Even though it's hard to play when the internet's connection is slow, for me, it is becoming more fun, why? Because I can hear my classmates shouting because of the weak signal. It also makes me more competitive because I can see the scores of my classmates. Overall, Kahoot is a fun way to learn in this world of technology."

Another response from the journal of student 1,

"My Kahoot experience is fun and enjoyable. It's a mix of emotions. Whenever I do activity in Kahoot, I feel like I am just playing a game."

Similar experiences were recorded as stated in the students' reflective journal.

Enhanced Lesson Exemplars

The integration of Kahoot into validated lesson exemplars proved effective in reducing science anxiety, shifting students from high to moderate levels across dimensions. This outcome supports prior research showing that structured, contextualized instructional design can mitigate anxiety and foster confidence (Ginsburg et al., 2021; Franks et al., 2023). It has significantly transformed the classroom dynamics of our daily discussions, making Physical Science sessions more engaging, interactive, and student-centered. When used in the motivation stage, Kahoot served as a powerful tool that spark curiosity and excitement, drawing learners into the lesson with game-like challenges that immediately capture their interest. In the lesson proper, the platform provides opportunities for active participation, reinforcing key concepts through interactive questioning and collaborative competition. Finally, in the evaluation stage, Kahoot offered immediate feedback that allows both teacher and students to assess understanding in real time, ensuring that misconceptions are addressed promptly. This multifaceted usage of Kahoot like spanning motivation, instruction, and assessment has created a lively learning environment where students not only enjoy the process but also demonstrate improved confidence, retention, and enthusiasm for physical science. The comments of the teachers who observed the researcher during the implementation proved the claims. As observer 1 commented,

"Kahoot is fun and very interactive. The students are more active and livelier when the teacher used the application in teaching."

This comment was supported with the positive feedback of observer 2 that said,

"Kahoot is already been utilized in my previous school station and it's nice that it is practiced here in our school this time. Ma'am Khryss is really innovative to think of this strategy utilizing the school's free internet for students. It is evident that the students are having fun while learning.

4. CONCLUSIONS

The results of the study demonstrate that the integration of enhanced lesson exemplars, particularly with Kahoot, has a transformative impact on student learning in Physical Science. The findings revealed significant reductions in science performance anxiety and science communication anxiety, underscoring the effectiveness of gamified strategies in fostering confidence, motivation, and active participation. These outcomes imply that digital tools,

when strategically embedded in lesson design, can create a supportive and engaging classroom environment where students feel empowered to perform and communicate scientific ideas without fear of failure.

From a pedagogical perspective, the study highlights the importance of aligning lesson exemplars with interactive technologies to address both cognitive and affective domains of learning. The reduction of anxiety suggests that students are more likely to retain concepts, engage in collaborative discussions, and demonstrate improved problem-solving skills. This has broader implications for curriculum development, as it validates the integration of game-based learning platforms as effective tools for motivation, lesson delivery, and evaluation. At the institutional level, the findings provide evidence that innovative teaching practices can enhance classroom climate and student outcomes, supporting the Department of Education's thrust toward learner-centered instruction. For science education research, the study contributes to the growing body of literature on reducing student anxiety through interactive and inclusive approaches. Ultimately, the significance of the findings lies in their potential to guide teachers, curriculum developers, and policymakers in adopting strategies that not only improve academic performance but also nurture confidence, enjoyment, and resilience in science learning.

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