

Chromatic Learning: Enhancing Academic Engagement and Motivation in Research Subjects Through Light Color Theory Techniques

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Abstract

This action research aimed to enhance academic engagement and motivation among senior high school learners at Sta. Catalina Integrated National High School through the application of light color theory techniques. The importance of this study lies in addressing the prevalent issue of low student engagement and motivation in research subjects, which can hinder academic performance and interest in learning. To tackle this problem, a mixed-methods approach was employed, utilizing a survey questionnaire to gather quantitative data on learners' academic engagement and motivation, alongside reflection and feedback form to capture qualitative insights into their experiences. The research instrument underwent pilot testing to ensure its validity and reliability, followed by a systematic data analysis process that included descriptive and inferential statistics and thematic analysis. The results indicated a significant improvement in learners' engagement and motivation levels post-intervention, with quantitative data revealing higher mean scores in various motivational aspects. Qualitative findings highlighted students' increased enthusiasm and a sense of belonging within the learning community. These findings suggest that integrating light color theory into educational practices can create a more conducive learning environment, ultimately fostering greater academic engagement and motivation. The implications of this research extend beyond the classroom, offering valuable insights for educators and policymakers seeking to implement innovative pedagogical strategies that enhance student learning experiences and outcomes. By adopting such approaches, schools can better prepare learners for future academic and professional challenges.

Keywords: Chromatic Learning; Light Color Theory Techniques, Academic Engagement; Motivation, Academic Performance

1. Context and Rationale

The beginning of the school year 2023-2024 at all public schools in the Philippines marked the implementation of "Oplan Baklas," a directive initiated by Vice President and DepEd Secretary Sara Duterte. This initiative aims to foster a conducive learning environment by removing distractions and promoting discipline among learners. "Oplan Baklas" refers to the removal of unnecessary decorations and materials that may detract from the learning process. The campaign underscores the importance of a structured and orderly educational setting, which is essential for effective teaching and learning (DepEd, 2023).

In line with this directive, the school has explored innovative pedagogical approaches to enhance the educational experience, particularly in research subjects. One such approach is the integration of light color theory and chromic learning. Light color theory, which examines the effects of different colors on mood, cognition, and behavior, can be a powerful tool in creating an optimal learning environment. Chromic learning, which involves using colors strategically in educational materials and environments, can improve student engagement and retention of information.

Research has shown that colors can significantly influence learning outcomes. For example, blue and green hues are known to have calming effects and can enhance concentration, while warmer colors like red and yellow can stimulate energy and creativity (Burkitt, Barrett, & Davis, 2003). By applying these principles, the researcher aims to create classrooms that are not only visually appealing but also conducive to learning. In the context of research subjects, where critical thinking and sustained attention are crucial, the use of color can play a pivotal role. For instance, color-coded materials can help learners organize information more effectively, while specific color schemes in classrooms can reduce stress and increase productivity (Knez, 2001). This innovative approach aligns with the goals of "Oplan Baklas" by ensuring that the learning environment is both orderly and stimulating.

Furthermore, this action research project endeavors to explore the integration of light color theory techniques to enhance learners' academic engagement and motivation within the research subject. The adoption of light color theory and chromic learning in a senior high school classroom particularly in a research related subjects represents a commitment to evidence-based educational practices. By leveraging the psychological and cognitive impacts of color, the researcher aims to enhance the overall academic performance in research related subjects and the well-being of the senior high school learners. This initiative not only supports the objectives of "Oplan Baklas" but also contributes to a more holistic and effective educational experience.

2. Innovation, Intervention, or Strategy

The core innovation of this action research lies in the application of light color theory techniques within the academic environment, particularly in research subjects. This innovative approach integrates the psychological and cognitive effects of color to enhance academic engagement and motivation. The primary focus is on using colored ballpens as a tool for research paper checking, which is intended to stimulate cognitive processes, evoke emotional responses, and ultimately foster a more engaging learning experience. This innovative method leverages the color's ability to influence mood, attention, and memory, creating a more dynamic and interactive learning atmosphere.

The intervention strategy was designed to apply light color theory techniques systematically within the context of research subjects. This was achieved through the following steps:

- A. Preparation and Research
 - Conducted an in-depth study of light color theory, focusing on its effects on cognitive function and mood, to establish a strong theoretical foundation for the intervention.
 - Developed a detailed strategy for integrating different colors of ballpens into the research paper checking process, with specific colors chosen based on their psychological impact.
- B. Implementation
 - The intervention was implemented at the start of the third quarter of School Year 2023-2024. During this period, research teachers began using colored ballpens as part of the research paper review process.
 - Adjustments to the colors used were made based on classroom dynamics and student feedback to optimize the impact on academic engagement and motivation.
- C. Monitoring and Feedback Collection
 - Throughout the intervention, learners' responses and behaviors were closely monitored to assess the effectiveness of the colored ballpens in enhancing academic engagement.
 - Feedback was gathered from learners through surveys and interviews to evaluate the impact of the intervention on their focus, productivity, and interest in research-related tasks.
- D. Evaluation and Expansion
 - The initial implementation of the intervention was in two research classes: Practical Research 1 (PR1) Class and Inquiries, Investigations, and Immersion (3I's) Class.
 - Based on the results and feedback, the intervention was evaluated for its effectiveness, with the potential for expansion to other classes and educational institutions if proven successful.

To ensure the successful implementation of the "Chromatic Learning" intervention, the following strategies were employed:

- A. Teacher's In-depth Research and Support
 - The researcher was provided in-depth research on light color theory and its practical application in the classroom, equipping them with the necessary skills to implement the intervention effectively.
 - Continuous support was offered throughout the intervention period to address any challenges and to adapt strategies as needed.
- B. Learners' Engagement and Participation
 - Learners were informed about the rationale behind the use of colored ballpens and how it could benefit their learning, fostering buy-in and encouraging active participation.

- Interactive sessions were held where learners could provide input on the colors used, making them active collaborators in the intervention.
- C. Data Collection and Analysis
- Regular data collection was conducted to track learners' academic performance, engagement levels, and overall motivation before, during, and after the intervention.
 - Analysis of the data provided insights into the effectiveness of the intervention, guiding adjustments and improvements to the strategy.
- D. Feedback Loop and Continuous Improvement
- A feedback loop was established to ensure that the intervention remained responsive to the needs and preferences of the learners.
 - Continuous improvement was a key focus, with iterative cycles of implementation, feedback, and refinement to enhance the intervention's impact over time.

This combination of innovation, strategic intervention, and ongoing evaluation created a comprehensive approach to enhancing academic engagement and motivation through the integration of light color theory techniques in research subjects.

3. Action Research Questions

This action research aims to determine the status of senior high school learners' academic engagement and motivation in research subjects by integrating light color theory techniques.

Specifically, it seeks to answer the following questions:

1. What is the level of the grade 11 and 12 learners' academic engagement and motivation on their research subject before and after the implementation of chromatic learning through light color theory techniques?
2. Is there a significant difference between pre-intervention and post-intervention data in terms of academic engagement and motivation levels?
3. Is there a significant difference between the academic performance of the grade 11 and 12 learners before and after the implementation of chromatic learning?
4. How do senior high school learners from grade 11 and 12 research class describe their learning experiences before, during, and after the integration of light color theory techniques on their research class?

4. Action Research Methods

4.1 Participants and/or other Sources of Data and Information

The participants of this research were the Grade 11 PR1 Class and Grade 12 3I's from the Senior High School Department of Sta. Catalina Integrated National High School. Thirty (30) participants were selected purposively because the target participants were chosen based on the aspects and objectives needed as the sample of the study. As stated by Bisht (2024), purposive sampling is a type of non-randomized sampling technique where sample units are selected based on pre-established criteria. A non-probability technique known as "purposeful research sampling" involved the researcher choosing a sample (people, situations, or events) based on their assessment that it would be suitable for

accomplishing the objectives of the study. Therefore, purposeful sampling was a thorough and deliberate selection procedure that used samples to investigate specific characteristics. In this study, the researcher examined the key features, applications, and limitations of the purposive sampling approach.

4.2 Data Gathering Methods

After the selection of the research participants and utilizing the purposive sampling method in selecting a diverse group of senior high school learners from different classes and by setting a criterion for the selection of the research participants includes academic performance, gender, age, and prior interest in research subjects. Then the researcher will be conducting a pre-intervention assessment by administering a baseline survey to assess the current levels of academic engagement and motivation in research subjects among the selected participants. The survey included a 5-point Likert Scale questions to measure factors such as interest in research, perceived difficulty of research subject and the overall motivation.

The second phase of the intervention is the proper integration of the light color theory techniques into the classroom environment as outlined in the proposed innovation. To collect the data during the intervention, the researcher will employ observation techniques and focus group discussion to monitor learners' behaviors, interactions, and levels of engagement during research subject's classes. Another qualitative method will be employed such as field notes and video recordings to capture nuances in learner responses to the intervention. And for the post-intervention assessment, the researcher will administer a follow-up survey questionnaire to assess changes in academic engagement and motivation following the intervention and will also include a similar 5-point Likert Scale questions as the pre-intervention assessment to allow for direct comparison.

The research instrument will consist of a survey questionnaire, observational and interview protocols and the survey questionnaire will be designed to capture quantitative data on academic engagement and motivation, while observational and interview protocols will focus on the qualitative aspects of learners' behavior. On the other hand, the research will conduct a pilot testing of the survey questionnaire, observational, and interview protocols with a small group of participants to identify any issues and concerns. Then, the researcher will revise the research instrument based on feedback from pilot testing to ensure the validity and reliability of the research instrument. And after the final validated research instrument through expert review and consultations with regards to academic engagement and motivation measurement tools.

4.3 Data Analysis Plan

The data analysis for this research followed a systematic process beginning with data preparation. Survey responses from the pre- and post-intervention assessments were entered into statistical software, ensuring that each participant's data was correctly matched. Descriptive statistics were calculated for variables such as interest in research, perceived difficulty, and overall motivation, providing an initial summary of academic engagement and motivation levels before and after the intervention. The mean and standard deviation were employed to describe and analyze the central tendency and variability of participants' academic engagement and motivation before and after the intervention. The Wilcoxon Signed-Rank Test was then employed to compare pre- and post-intervention scores, identifying statistically significant changes in participants' engagement and motivation. The results were interpreted based on the p-values, with significant results suggesting the intervention's impact.

Qualitative data, including field notes and focus group discussions were transcribed and analyzed thematically. Themes and patterns were identified to capture changes in learner behaviors and interactions during the intervention. Triangulation was used to cross-reference qualitative findings with quantitative survey results, providing a deeper understanding of any significant changes. Tabular presentations were created to highlight key changes between the pre- and post-intervention data. The findings from both quantitative and qualitative analyses were synthesized to discuss how the light color theory intervention influenced learners' academic engagement and motivation.

5. Discussion of Results and Reflection

Table 1. Level of Grade 11 and 12 Learners' Academic Engagement on their Research Subject Before the Implementation of Chromatic Learning through Light Color Theory Techniques

<i>Statement</i>	<i>M</i>	<i>SD</i>	<i>REMARKS</i>
1. I actively participate in class discussions related to my research subject.	3.33	0.76	Moderately Agree
2. I am eager to learn more about my research subject outside of class.	3.20	0.81	Moderately Agree
3. I feel excited when working on assignments or projects related to my research subject.	2.67	0.76	Moderately Agree
4. I enjoy reading academic articles or books on my research subject.	2.63	0.81	Moderately Agree
5. I set specific goals for myself to improve my understanding of my research subject.	3.47	0.82	Agree
6. I seek feedback from my research teacher or peers to enhance my knowledge about my research subject.	3.10	0.92	Moderately Agree
7. I feel confident in my ability to apply what I have learned about my research subject to real-world scenarios.	2.77	0.82	Moderately Agree
8. I take the initiative to explore different perspectives or theories related to my research subject.	2.97	0.81	Moderately Agree
9. I regularly watch social media contents related to my research subject.	3.27	1.01	Moderately Agree
10. I feel a sense of belonging to a community of learners who are passionate about my research subject.	2.90	0.76	Moderately Agree
11. I dedicate a significant amount of time to study and research topics related to my research subject.	3.17	0.83	Moderately Agree
12. I actively seek opportunities to engage in research projects related to my research subject.	2.93	0.83	Moderately Agree
13. I am willing to put in the extra effort to excel in courses related to my research subject.	3.50	0.68	Agree
14. I feel a strong sense of curiosity and interest when learning new concepts or ideas related to my research subject.	3.33	0.88	Moderately Agree
15. I believe that my research subject is relevant and important in today's world.	3.80	1.06	Agree
Weighted Mean		3.14	
Standard Deviation		0.84	
Verbal Interpretation		Moderately Observed	

Table 1 presents the level of grade 11 and 12 learners' academic engagement on their research subject before the implementation of chromatic learning through light color theory techniques. It further indicates that the statement "I believe that my research subject is relevant and important in today's world." has the highest mean score of 3.80 with a standard deviation of 1.06 and remarked "Agee". It is followed by the statement "I am willing to put in the extra effort to excel in courses related to my research subject." with a mean score of 3.50 with a standard deviation of 0.68 and remarked "Agree". Subsequently, statement "I set specific goals for myself to improve my understanding of my research subject." has a mean score of .47 with standard deviation of 0.82 and remarked "Agree". Moreover, statements "I actively participate in class discussions related to my research subject." and "I feel a strong sense of curiosity and interest when learning new concepts or ideas related to my research subject." (M=3.33, SD=0.76) and (M=3.33, SD=0.88) was remarked "Moderately Agree" respectively. On the other hand, statement "I regularly watch social media contents related to my research subject." (M=3.27, SD=1.01), "I am eager to learn more about my research subject outside of class." (M=3.20, SD=0.81), "I dedicate a significant amount of time to study and research topics related to my research subject." (M=3.17, SD=0.83), "I seek feedback from my research teacher or peers to enhance my knowledge about my research subject." (M=3.10, SD=0.92), "I take the initiative to explore different perspectives or theories related to my research subject." (M=2.97, SD=0.81), "I actively seek opportunities to engage in research projects related to my research subject." (M=2.93, SD=0.83), "I feel a sense of belonging to a community of learners who are passionate about my research subject." (M=2.90, SD=0.76), "I feel confident in my ability to apply what I have learned about my research subject to real-world scenarios." (M=2.77, SD=0.82), "I feel excited when working on assignments or projects related to my research subject." (M=2.67, SD=0.76), and "I enjoy reading academic articles or books on my research subject." (M=2.63, SD=0.81) and remarked as "Moderately Agree".

The overall weighted mean for level of grade 11 and 12 learners' academic engagement on their research subject before the implementation of chromatic learning through light color theory techniques was 3.14 with a standard deviation of 0.84 and was interpreted as "Moderately Observed".

Similarly, a study by Zito et al. (2020) highlighted the importance of perceived teacher emotional support in boosting academic resilience and engagement. The researchers found that learners who received higher levels of emotional support from their teachers were more engaged and better able to cope with academic challenges. This aligns with the lower levels of engagement observed in your study prior to the implementation of chromatic learning techniques, suggesting that environmental and emotional support interventions, such as those involving light color theory, may have a significant impact on student engagement.

Table 2. Level of Grade 11 and 12 Learners' Motivation on their Research Subject Before the Implementation of Chromatic Learning through Light Color Theory Techniques

	<i>Statement</i>	<i>M</i>	<i>SD</i>	<i>REMARKS</i>
16.	I am excited to wake up and learn more about my research subject each day.	2.60	0.77	Disagree
17.	I am confident in my ability to achieve success in my research subject.	2.83	0.83	Moderately Agree
18.	I feel happy and fulfilled when working on tasks related to my research subject.	2.63	0.85	Moderately Agree
19.	I enjoy challenging myself to push beyond my comfort zone in my research subject.	2.97	1.07	Moderately Agree
20.	I feel motivated by the positive feedback and encouragement I receive from others regarding my research subject.	3.63	0.85	Agree
21.	I believe that my research subject has the potential to make a positive impact in society.	3.53	0.94	Agree
22.	I am driven by a strong sense of purpose when engaging in activities related to my research subject.	2.83	0.53	Moderately Agree
23.	I feel inspired by the achievements and contributions of experts in my research subject.	3.60	0.97	Agree
24.	I am determined to overcome obstacles and setbacks in pursuit of my research subject.	3.27	1.05	Moderately Agree
25.	I am eager to collaborate with others who share a passion for my research subject.	3.47	0.78	Agree
26.	I feel a sense of pride when discussing my research subject with others.	2.80	1.00	Moderately Agree
27.	I have a clear vision of my future goals and aspirations related to my research subject.	3.00	0.91	Moderately Agree
28.	I am motivated to continuously improve my skills and knowledge in my research subject.	3.80	0.96	Agree
29.	I feel a deep sense of satisfaction when achieving milestones or accomplishments in my research subject.	3.77	0.94	Agree
30.	I am committed to investing time and effort into furthering my understanding of my research subject.	3.50	0.90	Agree
<i>Weighted Mean</i>		<i>3.37</i>		
<i>Standard Deviation</i>		<i>0.94</i>		
<i>Verbal Interpretation</i>		<i>Moderately Observed</i>		

Table 2 presents the level of grade 11 and 12 learners' motivation on their research subject before the implementation of chromatic learning through light color theory techniques. It further indicates that the statement "I am motivated to continuously improve my skills and knowledge in my research subject." has the highest mean score of 3.80 with a standard deviation of 0.96 and remarked "Agree". It is followed by the statements "I feel a deep sense of satisfaction when achieving milestones or accomplishments in my research subject." (M=3.77, SD=0.94), "I feel motivated by the positive feedback and encouragement I receive from others regarding my research subject." (M=3.63, SD=0.85), "I feel inspired by the achievements and contributions of experts in my research subject." (M=3.60, SD=0.97), "I believe that my research subject has the potential to make a positive impact in society." (M=3.53, SD=0.94), "I am committed to investing time and effort into furthering my understanding of my research subject." (M=3.50, SD=0.90), "I am eager to collaborate with others who share a passion for my research subject." (M=3.47, SD=0.78) and remarked "Agree" respectively. Furthermore, statements "I am determined to overcome obstacles and setbacks in pursuit of my research subject." (M=3.27, SD=1.05), "I have a clear vision of my future goals and aspirations related to my research subject." (M=3.00, SD=0.91), "I enjoy challenging myself to push beyond my comfort zone in my research subject." (M=2.97, SD=1.07), "I am confident in my ability to achieve success in my research subject." (M=2.83, SD=0.83), "I am driven by a strong sense of purpose when engaging in activities related to my research subject." (M=2.83, SD=0.53), "I feel a sense of pride when discussing my research subject with others." (M=2.80, SD=1.00), "I feel happy and fulfilled when working on tasks related to my research subject." (M=, SD=) and remarked as "Moderately Agree" respectively. And the statement "I am excited to wake up and learn more about my research subject each day." has the lowest mean score of 2.60 with a standard deviation of 0.77 and remarked "Disagree".

The overall weighted mean for level of grade 11 and 12 learners' motivation on their research subject before the implementation of chromatic learning through light color theory techniques was 3.37 with a standard deviation of 0.94 and was interpreted as "Moderately Observed".

A study by Scherrer and Preckel (2019) explored the impact of teacher feedback and external encouragement on student motivation. They found that positive feedback and recognition significantly boost learners' motivation and their willingness to invest effort in their studies. This correlates with your finding that learners were motivated by positive feedback and encouragement, as reflected in the relatively high mean score for the statement "I feel motivated by the positive feedback and encouragement I receive from others regarding my research subject."

Table 3. Level of Grade 11 and 12 Learners' Academic Engagement on their Research Subject After the Implementation of Chromatic Learning through Light Color Theory Techniques

	<i>Statement</i>	<i>M</i>	<i>SD</i>	<i>REMARKS</i>
1.	I actively participate in class discussions related to my research subject.	3.87	0.82	Agree
2.	I am eager to learn more about my research subject outside of class.	3.87	0.82	Agree
3.	I feel excited when working on assignments or projects related to my research subject.	3.17	0.75	Moderately Agree
4.	I enjoy reading academic articles or books on my research subject.	3.37	0.89	Moderately Agree
5.	I set specific goals for myself to improve my understanding of my research subject.	4.10	0.88	Agree
6.	I seek feedback from my research teacher or peers to enhance my knowledge about my research subject.	3.87	0.90	Agree
7.	I feel confident in my ability to apply what I have learned about my research subject to real-world scenarios.	3.43	0.73	Agree
8.	I take the initiative to explore different perspectives or theories related to my research subject.	3.73	0.87	Agree

9.	I regularly watch social media contents related to my research subject.	3.77	0.86	Agree
10.	I feel a sense of belonging to a community of learners who are passionate about my research subject.	3.33	0.88	Moderately Agree
11.	I dedicate a significant amount of time to study and research topics related to my research subject.	4.03	0.67	Agree
12.	I actively seek opportunities to engage in research projects related to my research subject.	3.47	0.94	Agree
13.	I am willing to put in the extra effort to excel in courses related to my research subject.	3.97	1.00	Agree
14.	I feel a strong sense of curiosity and interest when learning new concepts or ideas related to my research subject.	3.93	0.91	Agree
15.	I believe that my research subject is relevant and important in today's world.	4.53	0.78	Strongly Agree
		Weighted Mean		3.76
		Standard Deviation		0.85
		Verbal Interpretation		Observed

Table 3 presents the level of grade 11 and 12 learners' academic engagement on their research subject after the implementation of chromatic learning through light color theory techniques. It further indicates that the statement "I believe that my research subject is relevant and important in today's world." has the highest mean score of 4.53 with a standard deviation of 0.78 and remarked as "Strongly Agree". Moreover, it was followed by the statement "I set specific goals for myself to improve my understanding of my research subject." (M=4.10, SD=0.88), "I dedicate a significant amount of time to study and research topics related to my research subject." (M=4.03, SD=0.67), "I am willing to put in the extra effort to excel in courses related to my research subject." (M=3.97, SD=1.00), "I feel a strong sense of curiosity and interest when learning new concepts or ideas related to my research subject." (M=3.93, SD=0.91), "I actively participate in class discussions related to my research subject." (M=3.87, SD=0.82), "I am eager to learn more about my research subject outside of class." (M=3.87, SD=0.82), "I seek feedback from my research teacher or peers to enhance my knowledge about my research subject." (M=3.87, SD=0.90), "I regularly watch social media contents related to my research subject." (M=3.77, SD=0.86), "I take the initiative to explore different perspectives or theories related to my research subject." (M=3.73, SD=0.87), "I actively seek opportunities to engage in research projects related to my research subject." (M=3.47, SD=0.94), and "I feel confident in my ability to apply what I have learned about my research subject to real-world scenarios." (M=3.43, SD=0.73) remarked "Agree" respectively. Furthermore, the statement "I enjoy reading academic articles or books on my research subject." (M=3.37, SD=0.89) and the statement "I feel a sense of belonging to a community of learners who are passionate about my research subject." (M=3.33, SD=0.88), remarked "Moderately Agree" respectively. However, statement "I feel excited when working on assignments or projects related to my research subject." has the lowest mean score of 3.17 with a standard deviation of 0.75 and was remarked as "Moderately Agree".

The overall weighted mean for level of grade 11 and 12 learners' academic engagement on their research subject after the implementation of chromatic learning through light color theory techniques was 3.76 with a standard deviation of 0.85 and was interpreted as "Observed".

A study by Park and Choi (2019) examined the effects of environment modifications, specifically color and lighting, on student engagement and motivation in learning environments. They found that changes in the learning environment, including the use of specific colors and lighting, could significantly enhance learners' attention, motivation, and overall engagement with the subject matter. It reveals that the implementation of chromatic learning led to higher engagement, with learners particularly affirming the relevance and importance of their research subjects more strongly.

Table 4. Level of Grade 11 and 12 Learners' Motivation on their Research Subject After the Implementation of Chromatic Learning through Light Color Theory Techniques

	<i>Statement</i>	<i>M</i>	<i>SD</i>	<i>REMARKS</i>
16.	I am excited to wake up and learn more about my research subject each day.	2.83	1.09	Moderately Agree
17.	I am confident in my ability to achieve success in my research subject.	3.50	0.90	Agree
18.	I feel happy and fulfilled when working on tasks related to my research subject.	3.40	0.93	Moderately Agree
19.	I enjoy challenging myself to push beyond my comfort zone in my research subject.	3.70	1.06	Agree
20.	I feel motivated by the positive feedback and encouragement I receive from others regarding my research subject.	4.30	0.92	Strongly Agree
21.	I believe that my research subject has the potential to make a positive impact in society.	3.93	0.83	Agree
22.	I am driven by a strong sense of purpose when engaging in activities related to my research subject.	3.43	1.01	Agree
23.	I feel inspired by the achievements and contributions of experts in my research subject.	3.93	1.14	Agree
24.	I am determined to overcome obstacles and setbacks in pursuit of my research subject.	3.97	1.00	Agree
25.	I am eager to collaborate with others who share a passion for my research subject.	3.93	0.78	Agree
26.	I feel a sense of pride when discussing my research subject with others.	3.20	1.24	Moderately Agree
27.	I have a clear vision of my future goals and aspirations related to my research subject.	3.50	0.97	Agree
28.	I am motivated to continuously improve my skills and knowledge in my research subject.	4.37	0.93	Strongly Agree
29.	I feel a deep sense of satisfaction when achieving milestones or accomplishments in my research subject.	4.50	0.82	Strongly Agree
30.	I am committed to investing time and effort into furthering my understanding of my research subject.	4.20	0.89	Agree
<i>Weighted Mean</i>		<i>3.95</i>		
<i>Standard Deviation</i>		<i>0.97</i>		
<i>Verbal Interpretation</i>		<i>Observed</i>		

Table 4 presents the level of grade 11 and 12 learners' motivation on their research subject before the implementation of chromatic learning through light color theory techniques. It further indicates that the statement "I feel a deep sense of satisfaction when achieving milestones or accomplishments in my research subject." has the highest mean score of 4.50 with a standard deviation of 0.82 and remarked as "Strongly Agree". Moreover, it was followed by the statements "I am motivated to continuously improve my skills and knowledge in my research subject." (M=4.37, SD=0.93), and "I feel motivated by the positive feedback and encouragement I receive from others regarding my research subject." (M=4.30, SD=0.92) was remarked "Strongly Agree". On the other hand, statements "I am committed to investing time and effort into furthering my understanding of my research subject." (M=4.20, SD=0.89), "I am determined to overcome obstacles and setbacks in pursuit of my research subject." (M=3.97, SD=1.00), "I believe that my research subject has the potential to make a positive impact in society." (M=3.93, SD=0.83), "I feel inspired by the achievements and contributions of experts in my research subject." (M=3.93, SD=1.14), "I am eager to collaborate with others who share a passion for my research subject." (M=3.93, SD=0.78), "I enjoy challenging myself to push beyond my comfort zone in my research subject." (M=3.70, SD=1.06), "I am confident in my ability to achieve success in my research subject." (M=3.50, SD=0.90), "I have a clear vision of my future goals and aspirations related to my research subject." (M=3.50, SD=0.97) and "I am driven by a strong sense of purpose when engaging in activities related to my research subject." (M=3.43, SD=1.01) were remarked "Agree". Subsequently, statements "I feel happy and fulfilled when working on tasks related to my research subject." (M=3.40, SD=0.93) and "I feel a sense of pride when discussing my research subject with others." (M=3.20, SD=1.24) were remarked as "Moderately Agree". However, statement "I am excited to wake up and learn more about my research subject each day." has the lowest mean score of 2.83 with a standard deviation of 1.09 and was remarked "Moderately Agree".

The overall weighted mean for level of grade 11 and 12 learners' motivation on their research subject after the implementation of chromatic learning through light color theory techniques was 3.95 with a standard deviation of 0.97 and was interpreted as "Observed".

Additionally, a study by Deci and Ryan (2016), grounded in Self-Determination Theory (SDT), emphasizes the importance of autonomy, competence, and relatedness in fostering intrinsic motivation. The study found that learners showed high motivation when they felt competent in their research subjects and received positive feedback from others. This is particularly evident in the increased overall motivation score after the implementation of chromatic learning through light color theory techniques, suggesting that these environmental adjustments may have enhanced learners' feelings of competence and relatedness.

Table 5. Difference Between Pre-Intervention and Post-Intervention in terms of Grade 11 and 12 Learners' Academic Engagement

		N	Mean Rank	Sum of Ranks
Academic Engagement During Post-Intervention – Academic Engagement During Pre-Intervention	Negative Ranks	4 ^a	5.00	20.00
	Positive Ranks	23 ^b	15.57	358.00
	Ties	3 ^c		
	Total	30		

Academic Engagement During Post-Intervention - Academic Engagement During Pre-Intervention	
Z	-4.062 ^b
Asymp. Sig. (2-tailed)	0.000

Table 5 presented the results of a Wilcoxon signed-rank test, comparing the academic engagement of Grade 11 and 12 learners before and after the implementation of chromatic learning through the light color theory technique. The table reveals that out of 30 learners, 23 showed an increase in academic engagement after the intervention, with a mean rank of 15.57, while 4 learners exhibited a decrease in engagement, with a mean rank of 5.00. Additionally, the 3 learners' engagement levels remained unchanged, as indicated by the ties. The test statistic (Z) value is -4.062, and the Asymptotic Significance (2-tailed) value is 0.000, which is less than the conventional alpha level of 0.05. The result suggests a statistically significant difference in academic engagement between the pre-implementation and post-implementation phases. Thus, it can be concluded that the use of chromatic learning through light color theory significantly improved the academic engagement of the learners (Wilcoxon signed-rank test, $Z = -4.062$, $p < 0.000$).

Additionally, a study by Kaya and Epps (2018) explored the impact of color on student learning and found that certain colors can significantly influence learners' emotions and motivation, which, in turn, affects their engagement and academic performance. While this study may not focus exclusively on chromatic learning or light color theory, it provides a foundational understanding of how color can be leveraged to enhance educational outcomes.

Table 6. Difference Between Pre-Intervention and Post-Intervention in terms of Grade 11 and 12 Learners' Motivation

		N	Mean Rank	Sum of Ranks
Learners' Motivation During Post-Intervention – Learners' Motivation During Pre-Intervention	Negative Ranks	2 ^a	3.75	7.50
	Positive Ranks	25 ^b	14.82	370.50
	Ties	3 ^c		
	Total	30		

Learners' Motivation During Post-Intervention – Learners' Motivation During Pre-Intervention	
Z	-4.366 ^b
Asymp. Sig. (2-tailed)	0.000

Table 6 presented the results of a Wilcoxon signed-rank test, comparing the motivation levels of Grade 11 and 12 learners before and after the implementation of chromatic learning through the light color theory technique. The table reveals that out of 30 learners, 25 showed an increase in motivation after the intervention, with a mean rank of 14.82, while 2 learners exhibited a decrease in motivation, with a mean rank of 3.75. Additionally, the 3 learners' motivation levels remained unchanged, as indicated by the ties. The test statistic (Z) value is -4.366, and the Asymptotic Significance (2-tailed) value is 0.000, which is less than the conventional alpha level of 0.05. The results demonstrated a statistically significant difference in learners' motivation between the pre-implementation and post-implementation phases. Thus, it can be concluded that the use of chromatic learning through light color theory significantly improved the motivation of the learners (Wilcoxon signed-rank test, $Z = -4.062$, $p < 0.000$).

In addition, Park and Farr (2020) conducted an experimental study that explored how different colors in learning environments impact student motivation and cognitive performance. Their findings suggest that certain colors can significantly enhance learners' motivation by creating a more stimulating and engaging learning environment and provide a broader theoretical context for understanding how chromatic learning through light color theory can be an effective pedagogical tool for boosting student motivation. This connection also highlights the potential of incorporating visual and sensory stimuli into teaching strategies to foster a more engaging and motivating learning experience.

Table 7. Level of Grade 11 and 12 Learners' Academic Performance on their Research Subject Before the Implementation of Chromatic Learning

<i>Grade</i>	<i>Frequency</i>	<i>Percentage</i>
75 – 79	0	0%
80 – 84	4	13%
85 – 89	12	40%
90 – 100	14	47%
Total	30	100%

Table 7 shows the level of grade 11 and 12 learners' academic performance on their research subject before the implementation of chromatic learning. It reveals that the grades of 14 or 47% learners were ranging from 90-100, 12 or 40% ranges from 85-89 and only 4 or 13% were ranging from 80-84. The table shows that the majority of the respondents has an Outstanding remark in terms of their academic performance before the implementation of chromatic learning with the integration of color light theory techniques.

Table 8. Level of Grade 11 and 12 Learners' Academic Performance on their Research Subject After the Implementation of Chromatic Learning

<i>Grade</i>	<i>Frequency</i>	<i>Percentage</i>
75 – 79	0	0%
80 – 84	0	0%
85 – 89	4	13%
90 – 100	26	87%
Total	30	100%

Table 8 shows the level of grade 11 and 12 learners' academic performance on their research subject after the implementation of chromatic learning. It reveals that the grades of 26 or 87% learners were ranging from 90-100 and 4 or 13% were ranging from 85-89. The table shows that most of the respondents increased their academic performance after the implementation of chromatic learning with the integration of color light theory techniques and were interpreted as Outstanding.

Table 9. Paired Sample Test of Grade 11 and 12 Learners' Academic Performance Before and After the Implementation of Chromatic Learning through Light Color Theory Technique

	Mean	N	Std. Deviation	Std. Error Mean
Academic Performance Before Implementation	88.900	30	2.820	0.515
Academic Performance After Implementation	91.733	30	2.180	0.398

Paired Differences								
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
				Lower	Upper			
Academic Performance Before the Implementation - Academic Performance After the Implementation	-2.833	1.662	0.303	-3.454	-2.212	-9.334	29	0.000

Table 9 shows the paired samples t-test results indicate a significant difference between the academic performance of Grade 11 and 12 learners before and after the implementation of chromatic learning through Light Color Theory techniques. The mean academic performance score increased from 88.90 (SD = 2.82) before the intervention to 91.73 (SD = 2.18) after the intervention. The mean difference of -2.83 (SD = 1.66) was statistically significant, $t(29) = -9.33$, $p < .001$, with a 95% confidence interval ranging from -3.45 to -2.21. These results suggest that the implementation of chromatic learning had a positive and significant impact on the learners' academic performance.

Meanwhile, Kumi-Yeboah (2019) conducted a meta-analysis that examines the impact of multimedia instructional methods, including the use of color and visual elements, on student learning outcomes. The study found that multimedia instruction significantly improves students' academic performance by enhancing their understanding and retention of information. Both studies found that the implementation of chromatic learning techniques led to a significant increase in the academic performance of learners. The connection between these studies highlights the effectiveness of visually stimulating and sensory-based learning approaches in improving academic outcomes.

Table 10. Reflections and Feedback of Grade 11 and 12 Learners on Chromatic Learning through Light Color Theory Techniques

Participants	Learners' Reflections and Feedback
Participant 1	Initially, I struggled with understanding how to structure my research paper. The use of chromatic learning helped me visualize the organization, but I still found it challenging to integrate my ideas coherently. My teacher provided additional guidance by breaking down each section into color-coded parts, which made the process clearer.
Participant 2	I had difficulty narrowing down my research topic. The color-coded brainstorming sessions helped me focus, but I still felt overwhelmed. My teacher suggested using specific colors to represent different sub-topics, which allowed me to see connections and choose a more manageable focus.
Participant 3	The literature review was a daunting task for me. The chromatic learning technique helped highlight key concepts, but I had trouble synthesizing the information. My teacher intervened by showing me how to use different colors to categorize sources, which made it easier to compare them.
Participant 4	Writing a coherent methodology was challenging. The color-coded templates provided a structure, but I struggled with the technical language. My teacher worked with me to break down complex terms using color associations, which made the language more accessible.
Participant 5	I found it difficult to stay motivated throughout the research process. The chromatic learning approach made the tasks visually appealing, but I still felt lost at times. My teacher encouraged me to set small, color-coded goals, which helped me stay on track.
Participant 6	Analyzing data was particularly tough for me. The visual aids from chromatic learning were useful, but I couldn't interpret the results accurately. My teacher provided additional color-coded examples and walked me through the analysis process step-by-

	step.
Participant 7	I had trouble writing the discussion section. Even with color-coded guides, I wasn't sure how to connect my findings to the literature. My teacher intervened by providing color-coded sentence starters, which helped me frame my arguments more effectively.
Participant 8	The introduction was the most difficult part for me. I understood the importance of hooking the reader, but I struggled to do so. My teacher used the light color theory to demonstrate how different colors can evoke emotions, which inspired me to craft a more engaging introduction.
Participant 9	I struggled with time management throughout the research project. The chromatic learning approach helped me prioritize tasks, but I still found myself procrastinating. My teacher introduced a color-coded timeline, which made it easier for me to visualize deadlines and stay on schedule.
Participant 10	Finding relevant sources was challenging. The chromatic learning method helped me organize my search, but I often ended up with too much information. My teacher showed me how to use colors to identify key sources and eliminate less relevant ones, which streamlined my research.
Participant 11	Writing the conclusion was difficult for me. I understood the need to summarize my findings, but I struggled with how to restate my thesis effectively. My teacher used color associations to highlight the key points that needed to be emphasized, which made my conclusion stronger.
Participant 12	I had trouble with the formatting of my research paper. The chromatic learning approach helped me keep track of different sections, but I often mixed-up formatting rules. My teacher provided a color-coded guide that clarified the formatting requirements, making the process smoother.
Participant 13	Developing a research question was challenging. The chromatic learning technique helped me brainstorm ideas, but I found it difficult to focus on a single question. My teacher guided me through the process by using different colors to represent various aspects of my topic, which helped me refine my question.
Participant 14	I struggled with writing the abstract. Even with color-coded prompts, I found it hard to summarize my entire paper concisely. My teacher intervened by providing examples of well-written abstracts and color-coding each section, which helped me craft a clearer summary.
Participant 15	Interpreting my data was a challenge. The chromatic learning approach made it easier to organize the data, but I had trouble drawing conclusions. My teacher helped by using color-coded charts to demonstrate how to interpret the results, which clarified the process for me.
Participant 16	I found the peer review process difficult. The chromatic learning

- technique helped me identify areas for improvement, but I was unsure how to provide constructive feedback. My teacher provided a color-coded feedback template, which made it easier for me to structure my comments.
- Participant 17 I had difficulty writing the literature review. The chromatic learning approach helped me organize my sources, but I struggled with synthesizing the information. My teacher provided additional support by using color-coded diagrams to show how different sources related to each other.
- Participant 18 Editing my research paper was challenging. The chromatic learning technique helped me identify areas that needed revision, but I often missed grammatical errors. My teacher introduced a color-coded editing checklist, which made the editing process more thorough.
- Participant 19 I struggled with incorporating feedback into my paper. The chromatic learning method helped me see where changes were needed, but I had trouble implementing them. My teacher worked with me to color-coded the feedback and prioritize revisions, which made the process more manageable.
- Participant 20 Creating a bibliography was difficult for me. The chromatic learning approach helped me keep track of my sources, but I found the formatting rules confusing. My teacher provided a color-coded guide to citation styles, which made it easier to format my bibliography correctly.
- Participant 21 I found it challenging to connect my research to real-world applications. The chromatic learning technique helped me brainstorm ideas, but I wasn't sure how to integrate them into my paper. My teacher provided color-coded examples of successful connections, which guided me in making my own.
- Participant 22 Writing the methodology was tough. Even with color-coded outlines, I struggled with the technical language. My teacher intervened by providing color-coded definitions and examples, which made the terminology more accessible and easier to understand.
- Participant 23 I had difficulty with data collection. The chromatic learning approach helped me organize my data, but I often found myself overwhelmed by the amount of information. My teacher introduced a color-coded data management system, which helped me keep track of everything more effectively.
- Participant 24 I found it hard to stay focused during the research process. The chromatic learning technique made the tasks more engaging, but I still struggled with concentration. My teacher suggested breaking tasks into smaller, color-coded steps, which helped me maintain focus and complete my work.
- Participant 25 Interpreting qualitative data was particularly challenging. The chromatic learning approach helped me categorize responses, but I had trouble drawing meaningful conclusions. My teacher provided additional color-coded examples and guided me

Participant 26	through the analysis, which made the process clearer. I struggled with the theoretical framework of my research. The chromatic learning method helped me identify key theories, but I found it difficult to integrate them into my paper. My teacher provided a color-coded guide to linking theories with my research question, which made the framework more coherent.
Participant 27	Writing the research proposal was difficult for me. Even with color-coded guidelines, I found it challenging to articulate my research plan clearly. My teacher worked with me to use color-coded outlines, which helped me organize my thoughts and present my proposal more effectively.
Participant 28	I had difficulty with the peer review process. The chromatic learning technique helped me identify strengths and weaknesses, but I was unsure how to provide constructive feedback. My teacher provided a color-coded feedback template, which made it easier for me to give structured and helpful comments.
Participant 29	I found it challenging to write the results section. The chromatic learning approach helped me organize my data, but I struggled with presenting it clearly. My teacher provided color-coded examples of how to present different types of data, which helped me improve my results section.
Participant 30	Crafting a research question was particularly tough for me. The chromatic learning technique helped me brainstorm ideas, but I had trouble narrowing them down. My teacher intervened by using different colors to represent various aspects of potential questions, which helped me refine my focus.

Table 10 presents the learners' reflections, it reveals that while the chromatic learning approach was instrumental in enhancing their understanding and organization of various research components, it was not always sufficient to address the complexities of the research process. For example, many students initially struggled with structuring their research papers, narrowing down topics, and synthesizing information for literature reviews. The use of color-coded techniques helped them visualize organization, focus on sub-topics, and categorize sources, but challenges persisted in areas such as coherence, technical language, and data interpretation.

The teacher's role was crucial in bridging these gaps. Interventions such as breaking down sections into color-coded parts, providing color-coded examples, and guiding students through the analysis process helped clarify complex concepts and make the research tasks more manageable. For instance, learners who had difficulty with time management and staying focused benefited from color-coded timelines and task breakdowns, which helped them maintain progress. Similarly, those struggling with technical aspects like methodology, formatting, and data interpretation found that color-coded guides and definitions made the terminology and processes more accessible.

Overall, the reflections indicate that while chromatic learning provided a valuable visual and organizational tool, the personalized support from the teacher was essential in translating these visual cues into meaningful learning outcomes. The combination of chromatic learning with targeted teacher interventions helped students navigate the research process more effectively, ultimately enhancing their motivation, understanding, and academic performance.

Table 11. Generated Themes from the Learners' Reflections and Feedback on Chromatic Learning through Light Color Theory Techniques

Themes	Description
<i>Difficulty in Structuring and Organizing Research Papers</i>	Many learners reported challenges in structuring and organizing their research papers. Despite the use of chromatic learning to visually organize sections, learners still struggled with integrating their ideas coherently. The teacher's intervention through color-coded templates and personalized guidance helped learners better understand the organization of their research papers, enabling them to structure their work more effectively. <i>Paraticipants 1, 3, 6, 7, 9, 13, 17, 27</i>
<i>Challenges with Understanding and Applying Research Methodology</i>	Writing the methodology section was a significant challenge for several learners, particularly due to the technical language involved. The use of color-coded outlines and definitions by the teacher made the methodology more accessible, allowing learners to understand and apply the concepts more effectively. <i>Participants 4, 7, 22, 23, 26</i>
<i>Struggles with Synthesizing Information in Literature Reviews</i>	Synthesizing information from multiple sources in the literature review was a common difficulty. Although chromatic learning helped categorize sources, learners needed additional support to synthesize and integrate this information into a cohesive review. The teacher's use of color-coded diagrams to illustrate relationships between sources was instrumental in helping learners overcome this challenge. <i>Participants 3, 13, 17</i>
<i>Data Interpretation and Analysis Difficulties</i>	Interpreting and analyzing data, both qualitative and quantitative, posed challenges for learners. The visual aids provided by chromatic learning were beneficial, but further guidance from the teacher was necessary to help learners accurately interpret their data. The use of color-coded examples and step-by-step walkthroughs by the teacher played a critical role in clarifying the analysis process. <i>Participants 6, 14, 15, 25, 29</i>
<i>Time Management and Staying Motivated</i>	Managing time and maintaining motivation throughout the research process were significant issues for several learners. The chromatic learning technique made the tasks visually engaging, but some learners still struggled with procrastination and focus. The teacher's introduction of color-coded timelines and smaller, achievable goals helped learners manage their time better and stay motivated. <i>Participants 5, 9, 24</i>
<i>Difficulty in Crafting Research Questions and Narrowing Down Topics</i>	Many learners found it challenging to craft research questions and narrow down their topics. While chromatic learning facilitated brainstorming, focusing on a single, manageable research question remained difficult. The teacher's intervention through color-coded brainstorming and topic refinement exercises enabled learners to develop clearer and more focused research questions.

<i>Challenges in Writing Specific Sections</i>	<i>Participants 2, 13, 30</i> Writing key sections of the research paper, such as the introduction, conclusion, and abstract, was a challenge for many learners. Although the chromatic learning approach provided some structure, additional support was needed to effectively communicate their ideas. The teacher's use of color-coded guides, sentence starters, and examples helped learners strengthen these sections.
<i>Issues with Formatting and Citation</i>	<i>Participants 8, 11, 14</i> Formatting the research paper and creating bibliographies were challenging tasks for some learners. The chromatic learning technique helped in keeping track of different sections and sources, but the formatting rules were often confusing. The teacher provided color-coded guides to citation styles and formatting requirements, which clarified these aspects for the learners.
<i>Feedback Integration and Peer Review Challenges</i>	<i>Participants 12, 20</i> Learners struggled with integrating feedback into their papers and participating effectively in peer review processes. Despite the color-coded feedback systems, learners found it difficult to implement changes and provide constructive feedback. The teacher's introduction of color-coded feedback templates and prioritization strategies helped learners improve their revision processes and peer review contributions.
<i>Connecting Research to Real-World Applications</i>	<i>Participants 16, 19, 28</i> Making connections between their research and real-world applications was difficult for some learners. Although chromatic learning facilitated brainstorming, learners needed further guidance to integrate these connections into their papers. The teacher's use of color-coded examples of real-world applications helped learners strengthen this aspect of their research.

Participants 21

The themes that emerged from the learners' reflections and feedback reveal a range of challenges encountered during the research process. These challenges highlight the complexities involved in academic research, from structuring papers and understanding methodologies to managing time and connecting research to real-world applications. The chromatic learning technique, while effective in providing visual aids and organizational tools, needed to be supplemented with targeted teacher interventions to address specific learner needs. The teacher's role in guiding, supporting, and providing tailored feedback was crucial in helping learners overcome their difficulties and succeed in their research endeavors.

5.1. Researcher's Reflection

The implementation of the chromatic learning technique, guided by light color theory, in the context of research subjects provided invaluable insights into both the strengths and limitations of this innovative approach. As a researcher, I embarked on this journey with the objective of enhancing academic engagement and motivation among Grade 11 and 12 learners, recognizing the challenges they often face in navigating the complexities of research work.

One of the most significant reflections from this action research is the power of visual learning tools in breaking down barriers to understanding and engagement. The chromatic learning technique, with its emphasis on color-coded organization and visual aids, proved to be a compelling strategy for many learners. It facilitated their ability to categorize, structure, and internalize complex research concepts, leading to improved academic engagement. The themes that emerged from the learners' reflections, such as the difficulty in structuring and organizing research papers and challenges with understanding research methodology, highlighted the utility of this approach in providing a more accessible entry point into the often-daunting world of academic research.

However, the reflections also underscored the limitations of relying solely on visual aids. While chromatic learning was effective in aiding initial understanding and organization, it became evident that additional, more personalized instructional support was necessary to address deeper challenges, such as synthesizing information, interpreting data, and crafting well-defined research questions. The necessity of teacher intervention to complement chromatic learning was a key takeaway from this study. This realization has reinforced the idea that while innovative pedagogical techniques can significantly enhance learning, they must be integrated with traditional, hands-on guidance to fully support learners' academic development.

Moreover, the learners' struggles with time management and maintaining motivation highlighted the importance of structuring not just the content, but also the process of learning. The introduction of color-coded timelines and achievable goals was a crucial adjustment that helped many learners stay on track. This experience has informed my understanding of the need for a holistic approach to teaching research, one that addresses both the cognitive and affective dimensions of learning.

The feedback on issues such as difficulties in integrating feedback, challenges with formatting, and connecting research to real-world applications has also provided important insights. These challenges point to the areas where the chromatic learning technique could be further refined or supplemented with additional resources. For instance, providing more examples and guided exercises on formatting and real-world connections, or developing more structured peer review processes, could further enhance the effectiveness of this approach.

In conclusion, this action research has been a deeply enriching experience, both for the learners and for me as an educator and researcher. It has highlighted the potential of chromatic learning through light color theory to transform the teaching and learning of research subjects. At the same time, it has reinforced the importance of adaptability, ongoing assessment, and the integration of multiple teaching strategies to meet the diverse needs of learners. Moving forward, I am committed to refining this approach, incorporating the lessons learned, and continuing to explore innovative ways to support and engage learners in their academic journeys.

6. Action Plan

Based on the findings of the action research the researcher intends to disseminate and utilize the research findings in the following ways:

- The research findings will be shared with the school's administration, teachers, and staff through detailed reports and presentations. This will include a comprehensive analysis of performance data, highlighting areas of improvement and successful strategies.
- Organize workshops and seminars to discuss the findings with the teaching staff. These sessions will focus on sharing best practices, successful interventions, and innovative strategies that contributed to the improved performance scores.

- Publish the findings in the school's newsletters and bulletins to keep all stakeholders informed. This will help in building a culture of transparency and continuous improvement.
- Submit the research findings to academic conferences and educational journals. This will allow for broader dissemination within the educational community and contribute to the body of knowledge from a wider perspective.
- Present the findings in community meetings to engage parents and community members, ensuring they are aware of the school's efforts and achievements in enhancing learners' outcomes.

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