

Integration of Subliminal Messages in Teaching Gas Laws

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Abstract

This research paper examines the impact of incorporating subliminal messages in teaching Gas Laws on students' perceptions and formative and summative assessments. The study collected data from a sample of students and analyzed their responses using descriptive statistical measures to determine the perception of the students on subliminal messages. The results indicate that students generally believe in the effectiveness of subliminal messages in improving academic performance and enhancing attention span. Overall, students perceived subliminal messages positively and found them helpful in learning Gas Laws with a mean of 3.55 and a standard deviation of 0.62. The study also found that students demonstrated a satisfactory level of mastery when subliminal messages were incorporated, and the use of subliminal messages had a positive impact on formative with an average score of 11.91 and a standard deviation of 2.91. In terms of the summative assessment scores the mean was 14.41 and standard deviation of 4.02. However, using inferential statistics the results indicate that there was no significant relationship between students' perception of subliminal messages and their scores in both formative ($r = -0.140$, $p = 0.387$) and summative assessments ($r = -0.141$, $p = 0.186$), challenging the effectiveness of such techniques in educational contexts. Additionally, no notable correlation between formative and summative assessment scores with the r and p value of ($r = 0.142$) and ($p = 0.183$) when subliminal messages were used. These findings indicate that subliminal messages did not significantly influence students' perceptions or assessment consistency in Gas Laws teaching.

Keywords: subliminal messages, gas laws, intervention, assessment, perception

1. Introduction

The fundamental aim of every learning institute throughout the continent is to assist every student to be able to achieve their planned goals. The diversity of students cognitive capabilities and needs to acquire information and knowledge depends vastly on the

population, therefore locating new supplementary interventions to further aid their learning capabilities is vital to attain the pre-planned goals of every learner and also to carry off the vision and mission of their learning institutions. Generally, acquisition of knowledge and information occurs in a lot of form and factors and that learning is “a process which leads to change, which occurs as a result of experience and increases the potential for improved performance and future learning” (Ambrose et al, 2010). Science related subjects have tons of perplexing information and details that require to be thoroughly discussed and promulgated accordingly with the assistance of emerging technologies, theories and tools to solidify learning experiences of each learner. And in order to further assist the learning acquisition of every student, utilization of subliminal messages might help to further address the needs of supplementary interventions.

Subliminal are messages below the boundary of conscious perception, which receptors or the brain cannot consciously notice, that is, “in the subliminal study, the threshold is the level of stimulus that the respondent is unaware of, he does not know that the stimulus was at all” (Chessman & Phillip, 1984). Recent findings provide compelling evidence that subliminal messages affect people’s responses. (Schlaghecken & Eimer, 2004), activate semantically related knowledge (Naccache & Dehaene, 2001), and even influence cognitive control in tasks (Lau & Passingham, 2007). Building on these findings, research has demonstrated effects of subliminal stimulation on goal pursuit, such as increased task performance after priming of achievement-related words (Hart & Albarracín, 2009), enhanced fluid consumption in a taste task after priming of drinking-related words (Strahan, Spencer, & Zanna 2002), and an increase in instrumental behavior leading to specific goals (such as helping another person by providing useful comments) after priming of names of significant others (such as a good friend) or occupations (such as nurse) associated with these goals (Aarts et al., 2002 & Fitzsimons & Bargh, 2003). However, the ability of subliminal stimulation to convey meaningful information has been debated for quite some time (Abrams & Greenwald 2000). Aside from that, subliminal messages are also known to alter a person’s current mood, boost their motivation, effect on what to buy and it’s widely used as political strategies to market their candidates and influence a person politically if to be exposed in one of those advertisements which incorporate subliminal messages or ways, relaying promises of a specific candidate and make their names easily to be recalled during voting. One aspect which subliminal messaging was used in a negative manner was when the President of Indonesia, Joko Widodo’s political infrastructure has been a sublimation of corruption. This sublimation occurs because the community is more dazzled to the physical appearance of the project, hence increasing Indonesia’s debt, (Br Gurusinga, 2017).

This study solely utilizes the use of visual subliminal messages to administer additional information to the students during class. Visual subliminal messages are subliminal stimuli related to sight or seeing (Parker, 2023). Words would be flashed across a screen in just a few milliseconds, too small a window for you to be aware of it (Rennie, 2016).

This study aims to determine the potential use and the effectiveness of utilizing subliminal messages as supplementary material in teaching chemistry. Specifically, it aims to answer the following questions; 1. What are the student’s perceptions on subliminal messages in terms of learning and feelings? 2. What are the student’s formative assessments after the integration of subliminal messages? 3. What are the student’s summative assessments after the integration of subliminal messages? 4. Is there a significant relationship between the student’s perception in the integration of subliminal messages towards their formative and summative assessment? 5. Is there a significant relationship between students’ scores in their Formative and Summative assessments?

2. Methodology

A quasi-experimental research design was used to meet the objectives of this study. This research design aimed to determine the effectiveness of visual subliminal messages when utilized as supplementary material in teaching science among the students. Quasi-experiments were studies that aimed to evaluate interventions but did not use randomization (Harris, 2006). This quasi-experimental design established a cause-and-effect relationship between an independent and dependent variable and did not rely on random assignment (L. Thomas, 2020). The respondents of this study is comprised of 10th grade students from four distinct sections, regardless of their gender, age, or intellectual proficiency. This approach was adopted to mitigate the potential for bias in the study. To ascertain the potential success of the study, data collection occurred through two distinct procedures. The first involved the use of an assessment tool, specifically a multiple-choice questionnaire divided into formative and summative tests. This tool aimed to gather data on respondents' assessment scores during exposure to subliminal messages over two consecutive days. The second procedure focused on gathering data regarding students' perceptions of the subliminal messages, accomplished through a Likert-scale survey questionnaire. The study spanned three consecutive days, during which the researchers presented the videos infused with subliminal messages to the students. The first two days focused on exposing the students to videos related to Boyle's law and Charles's law, respectively. Following each video presentation, students were given the opportunity to ask questions and seek clarifications. Subsequently, a 10-item multiple-choice quiz was administered as a formative assessment. The quiz was comprised of multiple-choice questions focusing on the inserted additional information flashed on the screen, as well as situational scenarios involving Boyle's and Charles's law. On the third and final day of the study, a 20-item summative quiz was administered to the students. The summative quiz was comprised of combined items derived from the first two formative quizzes. The arrangement of the items were scrambled to ensure that the student's understanding and information retention are thoroughly assessed. Following the completion of the quiz, students were provided with a Likert-scale survey questionnaire to assess their perceptions of subliminal messaging. The formative scores were ranked in accordance to the DO 8,s. 2015-Policy Guidelines on Classroom Assessment for K to 12 Basic Education Program in the Department of Education, Philippines.

3. Results and Discussion

3.1 Students Perception on Subliminal Messages

The table showcased and reflected the students' perceptions of subliminal messages in learning gas laws which is the first question this study wants to seek to answer. The data suggests a generally positive perception of subliminal messages. Specifically, students believe that subliminal messages have a positive impact on their scores on the assessment and attention span, with mean scores of 3.68 and 3.64, respectively, indicating agreement. However, when it comes to understanding specific academic topics, such as gas laws, the perception is more neutral, as seen in the lower mean score of 3.24 for enhancing understanding of gas laws, suggesting a more nuanced viewpoint. According to study conducted by Smith et al. (2019) he found that subliminal messages can positively influence motivation and confidence, aligning with the students' perceptions. Additionally, the study by Johnson (2020) demonstrated that subliminal messages can enhance attention, corroborating the students' beliefs. These results imply that subliminal messages may be more effective for general motivation and attention rather than targeted

comprehension of specific subjects, indicating potential for broader use in educational settings.

Overall, the findings suggest that the students perceive subliminal messages positively and believe they can improve learning and motivation. However, the effectiveness for specific content understanding requires further research.

Table 1: Students' Perception on Subliminal Messages.

Perception	Mean	SD	Description
Learning	3.55	0.54	Agree
1. The presence of subliminal messages enhances my understanding of the gas laws topics	3.24	0.77	Neutral
2. I believe that subliminal messages increased my engagement and focus during the learning process.	3.77	0.79	Agree
3. I believe that subliminal messages assisted me retaining the learned concepts to Gas Laws.	3.53	0.84	Agree
4. The inclusion of subliminal messages improves my overall learning experience in studying Gas Laws.	3.51	0.91	Agree
5. I believe that subliminal messages have improved my academic performance.	3.68	0.92	Agree
Feeling	3.54	0.71	Agree
1. I feel concerned about the potential negative effects of subliminal messages on my personality.	3.56	1.09	Agree
2. I feel more confident in my ability to apply Gas Laws principles in real-world situations after being exposed to subliminal messages.	3.44	0.96	Neutral
3. I feel skeptical about the effectiveness of subliminal messages on me.	3.49	0.80	Neutral
4. I feel that subliminal messages made the learning process of Gas Laws more enjoyable.	3.59	0.97	Agree
5. I feel that subliminal messages positively impacted my attention span during the lessons.	3.64	1.03	Agree
Overall	3.55	0.62	Agree

Legend: Mean Score and its Description

1.00-1.49 Strongly Disagree, 1.50-2.49 Disagree, 2.50-3.49 Neutral, 3.50-4.49 Agree, 4.50-5.00 Strongly Agree

3.2 Students Formative Assessment Scores using Subliminal Messages

Figure 1 below showcases the participant's formative scores, the scores were analyzed and categorized using frequency and percentage statistical tools. The scores are rank in accordance with the DO 8,s. 2015-Policy Guidelines on Classroom Assessment for K to 12 Basic Education Program. With a passing score for this Assessment is 50 percent (10/20). As such, the scores of the students are arranged in this manner, 0-9 Needs improvement, 10 to 11 Fairly Satisfactory, 12-13 Satisfactory, 14 to 15 Very satisfactory and 16 to 20 Outstanding. The participant's average score was 11.91 with a standard deviation of 2.91, as such their overall scores were satisfactory.

The result reveals that there are 21.11% (19 out of 90) students who got score ranges from 0 to 9 which needs improvement in the topic involved in this study while only 12.22% (11 out of 20) of the students got the score ranges from 16 to 20 which described as outstanding and most which correspond to 25.56% (23 out of 90) got the score of 10 to 11 which described as satisfactory. As an overall result the average score of the respondents were 11.91 (SD=2.91) which described as satisfactory. A research suggests subliminal

messages can positively impact academic performance through increased motivation, engagement, and attention span (Kinard & Thompson, 2008 & Moore, 2014). These studies align with the positive perception of subliminal messages reported in previous sections, suggesting potential benefits for learning outcomes. Thus the level of mastery of the respondents regarding the topic discuss when integrating subliminal messages is satisfactory means that the student is doing everything required at their year level It also indicates that the student has met the criteria for a learner to be at the appropriate level. The student is consistently meeting grade level standards and their skills are applied independently or with minimal assistance. Lastly, it's important to acknowledge individual differences in learning styles and susceptibility to subliminal influence (Unestahl & Nordström, 2000). The varied performance levels observed here could reflect these individual variations, highlighting the need for further research on personalized approaches to utilizing subliminal messages in education.

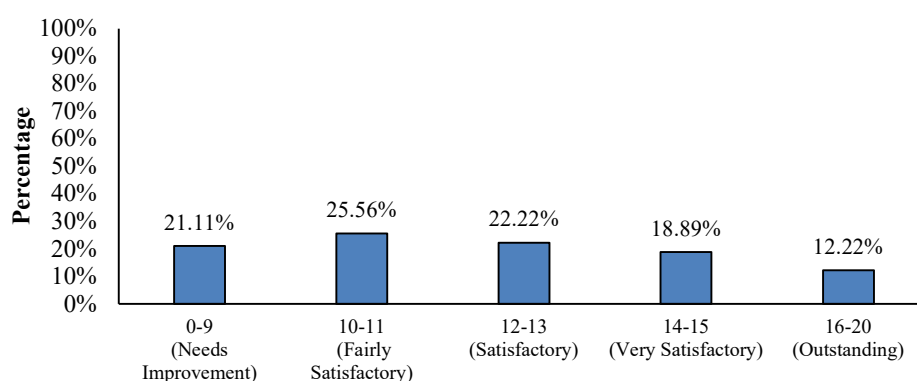


Figure 1: Formative Assessment of Students' Scores

3.3 Students Summative Assessment Scores

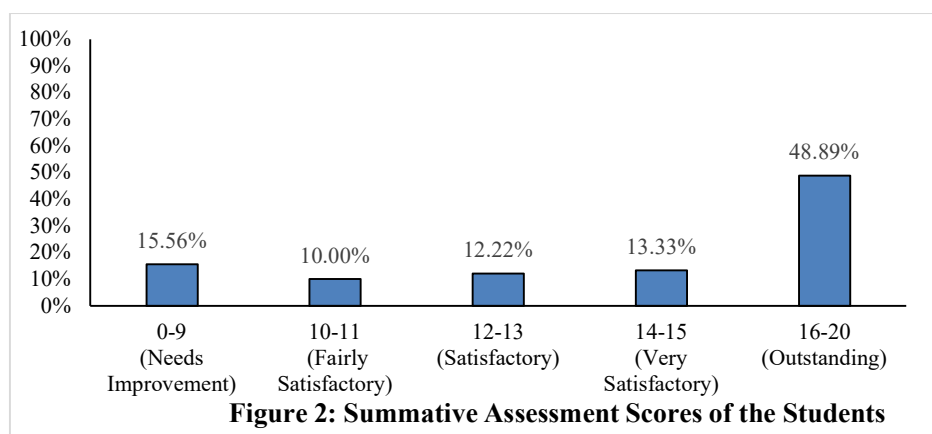
Summative scores below were analyzed and categorized using frequency and percentage statistical tools. The scores are rank in accordance with the DO 8, s. 2015-Policy Guidelines on Classroom Assessment for K to 12 Basic Education Program. With a passing score for this Assessment is 50 percent (10/20). As such, the scores of the students are arranged in this manner, 0-9 Needs improvement, 10 to 11 Fairly Satisfactory, 12-13 Satisfactory, 14 to 15 Very satisfactory and 16 to 20 Outstanding. The participant's average score was 14.41 with a standard deviation of 4.02, as such their overall scores were very satisfactory.

The results of the summative assessment, which incorporated the integration of subliminal messages in teaching Gas Laws, reveal a diverse distribution of scores among the students. A detailed analysis of the score percentages and frequencies indicates that most of the respondents performed exceptionally well, with 48.89% (44 out of 90) achieving scores of 16 to 20 described as outstanding. This suggests a noteworthy level of proficiency among a significant portion of the cohort.

On the lower end of the spectrum, 15.56% (14 out of 90) of students scored 9 and below which Needs Improvement. While this indicates room for improvement for a portion of the cohort, the overall distribution leans heavily towards satisfactory and outstanding performance. The calculated average score of 14.41 reflects a generally high level of achievement, and the standard deviation of 4.02 suggests a moderate degree of variability in the scores. The interpretation of "Very Satisfactory" aligns well with the

overall distribution of scores and reinforces the positive nature of the students' performance in the summative assessment with integrated subliminal messages.

In summary, the results of the summative assessment suggest that the incorporation of subliminal messages in teaching Gas Laws has had a positive impact on the students' performance, with a majority achieving scores in the satisfactory to outstanding range, thus indicating a successful implementation of the instructional approach which aligns to the findings of OECD (2015), students who are interested in science and actively engaged in learning tend to perform better.



3.4 Student's Perception in Integration of Subliminal Messages on Students' towards their Formative and Summative Assessment Scores

Table shows the relationship between Integration of Subliminal Messages on Students' Formative and Summative Assessment Scores. The r-value serves as the correlation coefficient, signifying the strength and direction of the relationship between two variables. A positive value suggests a positive correlation, while a negative value indicates a negative correlation, with values close to zero implying a weak correlation. The p-value is the probability of obtaining the observed correlation by chance, and a p-value less than 0.05 indicates statistical significance. Conversely, a higher p-value, as evidenced in this table, suggests a non-significant correlation. NS was placed as a remark, it denotes to "Not Significant," indicating that the observed correlation lacks statistical significance based on the p-value result.

The result reveals that there is no significant relationship exist between perception in integration of subliminal messages in terms of learning on students summative ($r = -0.160$, $p = 0.133$) and formative ($r = -0.11$, $p = 0.29$), another consistent result were also found in the perception of the respondents in terms of feeling which has no significant relationship on formative ($r = 0.139$, $p = 0.190$) and summative ($r = -0.102$, $p = 0.336$) assessment. As an overall result Perception of the respondents in integration of subliminal messages had no significant relationship on the performance of the respondents in summative ($r = -0.141$, $p = 0.186$) and formative ($r = -0.140$, $p = 0.387$) assessment. In the same vein, a research endeavor led by Azrinawati et al. (2015) focused on the perspectives of 331 Bachelor of Accounting students from both Malaysian private and public institutions, specifically exploring the aspects of interest and challenge in learning the accounting subject. The study revealed that there was no significant correlation between students' perceptions in these aspects and their assessment scores.

These findings are notable because they refute the widely held notion that subliminal messages have a major effect on learning outcomes. The results of this study contradict the widely held belief that subliminal messages included in educational context that it

affects students' performance. The effectiveness of subliminal messaging techniques in educational contexts is called into question by the lack of a significant relationship between students' perceptions of these messages and their formative and summative assessments. This is also reflected in the study conducted by Karremans, Stroebe, & Peters (2009) which showed that participants who are exposed to subliminal food logos while they viewed neutral images. Despite the subliminal exposure, participants showed no preference for the logo-associated food items compared to controls, both consciously and subconsciously.

The analysis of the data regarding to the relationship between the scores of the summative and formative assessment. The r -value, representing the correlation coefficient, indicates a weak positive correlation (0.142), signifying the strength and direction of the relationship between variables. A positive correlation suggests a positive relationship, while a negative correlation indicates the opposite. However, the correlation is not deemed statistically significant with a p -value of 0.183, exceeding the common significance level of 0.05. This implies that the observed correlation may have occurred by chance, as indicated by the "Not Significant" remark.

The findings from Table 4 indicate that the Pearson correlation coefficient (r -value) between formative and summative assessment scores in the integration of subliminal messages in teaching Gas Laws is 0.142, with a corresponding p -value of 0.183. The p -value is above the 0.05 level of significance, leading to the conclusion that the correlation is not statistically significant.

In statistical terms, when the p -value is greater than the chosen significance level (in this case, 0.05), it suggests that there is insufficient evidence to reject the null hypothesis. The null hypothesis typically assumes no significant relationship between the variables being tested. Therefore, based on the results presented, it can be concluded that there is no significant relationship between the formative and summative assessment scores of the respondents when they are exposed to the integration of subliminal messages in teaching Gas Laws. This suggests that the use of subliminal messages in teaching Gas Laws did not significantly impact the correlation between formative and summative assessment scores. Educators and researchers may interpret this as an indication that the integration of subliminal messages did not influence the consistency between ongoing formative assessments and the final summative assessment in the context of teaching Gas Laws. According to the findings of McMillan, (2010) promoting student agency within the formative assessment process can positively impact the relationship with summative performance. When students participate in setting learning goals, reflecting on their progress, and self-evaluating their work, they become more invested in their learning and strive for stronger summative performance.

Table 1: Relationship between Integration of Subliminal Messages on Students' Formative and Summative Assessment Scores

Perception	Assessment								
	Formative			Summative			Total		
	r-value	p-value	remarks	r-value	p-value	remarks	r-value	p-value	remarks
Learning	-0.08	0.482	NS	-0.11	0.29	NS	-0.13	0.24	NS
Feeling	0.139	0.190	NS	-0.13	0.213	NS	-0.05	0.628	NS
Overall	0.052	0.627	NS	-0.14	0.198	NS	-0.09	0.387	NS

Note: NS=Not Significant S=Significant $\alpha=0.05$

Table 2: Relationship between Formative and Summative Assessment Score in the Integration of Subliminal Messages in Teaching Gas Laws using Pearson Correlation

Relationship	r-value	p-value	remarks
Formative	0.142	0.183	Not Significant
Summative			
With 0.05 level of significance			

4. Conclusion and Recommendations

This study aimed to summarize the results of five research questions concerning the integration of subliminal messages in teaching gas laws and their impact on student performance and feelings. The research questions focused on student perceptions, formative and summative assessment scores, and the relationship between perception and assessment scores.

In regards to Student Perceptions about the use of subliminal messages in teaching gas law they generally believed in the effectiveness of subliminal messages, with a high mean score of 3.68 (SD=0.92) for improved academic performance. However, understanding specific academic topics such as gas laws received a lower mean score of 3.24 (SD=0.77), indicating a need for a more nuanced approach. Despite this, overall, the students had a positive attitude toward subliminal messages, with a mean score of 3.54 (SD=0.71).

In terms of formative assessment, 21.11% of the students scored between 0 to 9, while 25.56% scored 10 to 15. Notably, 12.22% achieved outstanding scores (16 to 20). The overall average score was 11.91 (SD=2.91), indicating satisfactory mastery of concepts when subliminal messages were incorporated.

In terms of the participant's summative assessment, results showed that 48.89% of students achieved outstanding scores (16 to 20), while 15.56% scored 9 and below. The overall distribution leaned towards satisfactory and outstanding performance, with an average score of 14.41 and a moderate degree of score variability (standard deviation of 4.02).

Additionally, the relationship between Perception and Performance found no significant relationship between the students' perception of subliminal message integration and their performance in both formative ($r=-0.11$, $p=0.29$) and summative ($r=-0.160$, $p=0.133$) assessments. This challenges the widely held belief that subliminal messages have a significant impact on learning outcomes.

Going with the Correlation between Formative and Summative Assessment Scores the data concluded that the correlation between formative and summative assessment scores in the integration of subliminal messages in teaching Gas Laws was not statistically significant ($r=0.142$, $p=0.183$). This suggests that the use of subliminal messages did not significantly impact the consistency between ongoing formative assessments and the final summative assessment.

In conclusion, the study found that the students had a positive attitude toward subliminal messages in learning gas laws. However, there was no significant relationship between students' perception of subliminal messages and their performance in both formative and summative assessments. The use of subliminal messages did not significantly impact the consistency between ongoing formative assessments and the final summative assessment. These findings suggest that the effectiveness of subliminal messages in educational contexts may be limited.

This study revealed the ineffectiveness and insignificance of subliminal messages in integration into the context of teaching gas laws. Thus, the following recommendations are hereby presented:

1. Since this study lasted only one school week we encourage future researchers to conduct a longitudinal study to investigate the long-term impact of integrating subliminal messages in teaching gas law concepts. This could

potentially track the academic performance and retention of knowledge over an extended period, such as one academic year, to determine if the effects of subliminal messages are sustained or diminish over time.

2. We also suggest investigating additional variables that may impact the learning process. Since this study only used the visual realm of subliminal messaging, we recommend for future researchers considering utilizing audible subliminal messaging to test out if there are any possible learning impacts.

3. Based on the specific location on where we first implemented this intervention, we recommend to integrate subliminal messages in a Science centered school to see the effect if this intervention will have a significant change based on a particular group of students.

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