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USE OF ARCS MODEL TO IMPROVE THE MOTIVATION LEVELS OF LOWER PERCENTILE RANKING STUDENTS OF GRADE 11 STEM CLASS

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ABSTRACT

This research investigated the effectiveness of the ARCS (Attention, Relevance, Confidence, and Satisfaction) model in enhancing the motivation of lower percentile ranking students in Grade 11 STEM classes at Gingoog City Comprehensive National High School (GCCNHS). Likewise, it aimed to address the challenges many educational institutions face in the Philippines in fostering enthusiasm for Science, Technology, Engineering, and Mathematics (STEM) subjects, particularly among students who struggle with motivation. The research sample comprised 20 lower percentile ranking students, selected using the nearest-rank method, who participated in a six-week intervention based on the ARCS model. Data were collected through pre- and post-intervention surveys, teacher observations, and focus group discussions. Findings revealed that students were classified as "Sometimes motivated," indicating low motivation levels before the intervention. After the ARCS model intervention, their motivation significantly improved to a "Moderately motivated" classification, indicating a positive impact on engagement and interest in the subject matter. Statistical analysis, including a t-test with a large effect size, confirms a significant difference in motivation levels before and after the intervention. Additionally, students perceived the ARCS model as "Moderately effective," highlighting strengths in capturing attention, using engaging multimedia, and employing interactive teaching methods. This research underscores the dynamic nature of student motivation and the potential of the ARCS model to enhance motivation and engagement among lower percentile-ranking students. The findings suggest that continued application of the ARCS model, focusing on relevance, personalized learning, accessibility, and self-efficacy support, can further sustain and improve student motivation, ultimately contributing to better academic performance and long-term success in STEM education.

Keywords: *STEM, ARCS Model, Motivation, Lower Percentile Students*

INTRODUCTION

Like many high schools in the Philippines, Gingoog City Comprehensive National High School (GCCNHS) faces challenges in providing quality education in Science, Technology, Engineering, and Mathematics (STEM) subjects. The Department of Education in the Philippines has identified STEM education as a priority area for development due to its importance for economic growth and development (DepEd, 2016). However, many students in STEM classes struggle with motivation and engagement, leading to poor academic performance and a lack of interest in pursuing STEM careers.

Research has shown that motivated and engaged students are more likely to succeed academically and in their careers. For example, a study by Fredricks et al. (2004) found that students who were more engaged in their coursework were likelier to have better academic outcomes, including higher grades and test scores. Similarly, a study by Ainley et al. (2002) found that students more motivated to learn had better academic outcomes than their less motivated peers.

Rawahi (2018) investigated the numerous factors that contribute to students' lack of motivation and engagement, such as the learning environment, teaching methods, and individual differences. The author also discusses the potential consequences of these factors, including poor academic performance, absenteeism, and a lack of interest in learning.

The ARCS (Attention, Relevance, Confidence, and Satisfaction) model is a widely used instructional design framework that aims to improve students' motivation and engagement in learning. Preliminary data from several studies suggest the need to conduct further research on the effectiveness of the ARCS model in different contexts. For instance, a study by Keller (2004) found that using the ARCS model in instructional design significantly improved students' motivation and learning outcomes in an e-learning environment. Another study by Afjar (2020) also found that the ARCS model enhanced students' motivation and learning outcomes in a traditional classroom setting. Additionally, Tay (2022) suggested that the ARCS model could effectively improve students' motivation and engagement in the context of game-based learning. These preliminary data indicate that the ARCS model may be a practical instructional design framework for promoting motivation and engagement in various learning contexts. However, further research is needed to confirm these findings and explore their potential limitations.

Therefore, the research aimed to contribute to the declining interest in learning by investigating the effectiveness of the ARCS model in motivating lower percentile ranking students in Grade 11 STEM classes in GCCNHS. The study's findings can potentially inform the development of more effective instructional

designs that promote the motivation and engagement of these students, leading to improved academic performance and increased interest in pursuing STEM careers.

FRAMEWORK

ARCS (Attention, Relevance, Confidence, and Satisfaction) is a motivational model widely used in instructional design to enhance learning and engagement in learners (Keller, 2010). The ARCS model was developed by John Keller, a professor of educational psychology at Florida State University in the 1980s, and it is based on the principles of motivation and cognitive psychology.

The ARCS model consists of four main components, each of which plays a critical role in enhancing learners' motivation and engagement:

Attention: This component focuses on capturing the learners' attention using various strategies such as engaging visuals, storytelling, and incorporating humor into the instructional design.

Relevance: This component emphasizes making the content relevant to learners' needs and interests. This can be achieved using real-world examples, case studies, and scenarios relating to learners' experiences.

Confidence: This component focuses on building learners' confidence in learning and applying the content. This can be done by providing clear instructions, feedback, and opportunities for learners to practice and apply their knowledge.

Satisfaction: This component emphasizes the importance of providing learners with satisfaction and achievement. This can be achieved by providing feedback, recognizing learners' efforts, and creating a positive learning environment.

The ARCS model effectively enhances learners' motivation and engagement in various settings, including traditional classroom settings, online learning environments, and corporate training programs (Keller, 2010). The model has also been adapted and modified to fit different instructional design contexts, such as game-based, mobile, and social learning.

Through the ARCS model in bridging the gap towards motivating learners of the lower percentile rank, the research focused on strategies and innovations such as:

Gamification: Game elements such as points, badges, and leaderboards were incorporated into the learning process to motivate students to participate actively in class activities and assessments. Games such as Kahoot, Quizizz, and Quizlet were used to make learning more enjoyable and interactive.

The following literature review provides an overview of some of the critical studies that have used ARCS or similar interventions to support the use of ARCS in instructional design.

Keller (1987) introduces the ARCS model as a framework for designing instruction that motivates learners. The article provides an overview of the four critical components of the ARCS model and offers practical guidance on applying the model in instructional design. The study by Lim et al. (2007) evaluates the effectiveness of the ARCS model in an online learning environment. The researchers found that using the ARCS model resulted in higher student motivation and engagement levels than a control group. Chen (2014) applies the ARCS model to design a multimedia-based English listening course.

The researchers found that using the ARCS model improved learner motivation and engagement and resulted in higher learning achievement levels than a traditional lecture-based course. Meireles (2015) evaluated the effectiveness of gamification in teaching the ARCS model, and he found that the game was effective in improving learners' motivation and understanding of the ARCS model. Similarly, Lee et al. (2015) noted that the ARCS model to a virtual reality simulation system is efficient. The researchers found that using the ARCS model improved learner motivation and engagement and resulted in higher learning achievement levels than a traditional simulation system.

According to Fadhli et al. (2020), the implementation of gamification methods aimed at enhancing the learning process has positively impacted students' motivation and behavior. The authors refer to a study by Hamari, Koivisto, and Sarsa (2014), which supports the notion that gamification can increase student motivation and behavior. Furthermore, Fadhli et al. (2020) highlight the role of technology in utilizing gamification as a tool for advancing civilization in the 21st century, citing Wangi et al. (2018). The researchers conducted a systematic review of 24 studies and found that gamification positively affects motivational affordances and psychological and behavioral outcomes. These findings align with research conducted by Brondino et al. (2014), who utilized path analysis to demonstrate that game elements can motivate learners to complete learning tasks. Fadhli et al. (2020) emphasize gamification's versatility, stating that it can be employed in various settings and demographics. This assertion is supported by Lamrani et al. (2018), who conducted research in rural Africa and observed the beneficial effects of gamification on subjects such as mathematics, language, social skills, and health.

These studies support using the ARCS model as a practical framework for designing instruction that motivates learners and improves learning outcomes.

Implementing the intervention involved the following steps:

(1) Needs assessment: A needs assessment was conducted to determine the specific learning needs and preferences of the lower percentile ranking students in the Grade 11 STEM class in GCCNHS.
(2) Design: Based on the needs assessment, the design of the intervention was developed. The design included the selection of appropriate technology tools and the creation of multimedia materials.
(3) Implementation: The intervention was implemented in the Grade 11 STEM class at Gingoog City Comprehensive National High School. The teacher facilitated the intervention's implementation and monitored the student's progress.
(4) Evaluation: The effectiveness of the intervention was evaluated through pre-and post-test assessments, student feedback, and teacher observations. The evaluation provided insights into the effectiveness of the intervention and identified areas for improvement.

MATERIALS AND METHODS

The participants in the study were the lower 25 percentile ranking students in a Grade 11 STEM class at Gingoog City Comprehensive National High School. The nearest-rank method (Giesbrecht, 2017) is a simple approach for calculating percentiles, mainly when dealing with discrete data or when an exact ranking is necessary. To use this method, such steps are followed:

a.) Obtain a list of all the students in the three sections of the Grade 11 STEM class who fall in the lower percentile rank based on their grades.
b.) Create a basis for demotivated students through surveys and questionnaires. Use a tool will from Wang (2017).
c.) Assign each student a number or identifier, such as their student ID or a random number assigned by a computer.
d.) Use a random number generator or a table of random numbers to select 20 participants from the entire population of lower 25 percentile ranking students.
e.) Contact the selected participants and invite them to participate in your study.

The data gathering method for the study involved collecting data on the effectiveness of the ARCS Model in improving the motivation and engagement of lower percentile ranking students in a Grade 11 STEM class in GCCNHS. A survey questionnaire was developed to gather information on the students' motivation, engagement, and interest in STEM subjects and their perceptions of the ARCS

Model interventions. The presurvey and post-survey questionnaires are from Wang (2017).

After the research was conducted, an overall questionnaire was created regarding the effectiveness of the four phases of the ARCS model. The questionnaires include Likert-type scales by Al-Rawashdeh (2018).

To further quantify the steps of data gathering and its sequential parts, phases were conducted:

Phase 1: Needs Assessment. The first phase of the research involved a needs assessment that identified the students' specific learning needs and preferences in the lower 25 percentile ranking in the Grade 11 STEM class. This assessment combined interviews with the students and consultations with their teachers. Survey questions were carefully designed to gauge the students' levels of motivation and engagement in their STEM classes, as well as their preferences for learning materials and methods. The interviews provided profound insights into the student's learning needs and challenges. The outcomes of this need assessment served as a foundation for shaping the intervention in phase 2.

Phase 2: Intervention and Evaluation. The second phase of the research comprised implementing the intervention proposed earlier, followed by evaluating its effectiveness. This intervention spanned six weeks and featured the integration of technology within the framework of the ARCS Model, incorporating gamification elements.

Quantitative data were collected through pre-and post-test assessments of the student's knowledge and skills in STEM subjects, along with their levels of motivation and engagement. The pre-test was administered before the intervention, while the post-test was conducted after the intervention. Data analysis employed descriptive and inferential statistics, specifically the T-test for Paired Means, to ascertain the effectiveness of the intervention in enhancing students' academic performance and motivation.

RESULTS AND DISCUSSION

On the Level of Motivation of Lower Percentile Ranking Students in the Grade 11 STEM Class in GCCNHS before the Use of the ARCS model

Table 1 presents the level of motivation of the learners before the use of the ARCS model.

The survey results, as seen in Table 1, show that the average level of motivation for the lower percentile ranking students was 2.82, which is classified as "Sometimes motivated." The table answers the problem of one of the research

questions. It means the students were not consistently motivated and sometimes felt bored, uninterested, and not good at the subject they were learning.

Table 1. *Level of Motivation of the Learners Before the Use of the ARCS Model*

Indicators	Mean	Description	Interpretation
1. How often do you feel like you are not interested in the topic being covered in class?	3.35	Sometimes	Slightly Motivated
2. How often do you feel bored when you are in class?	2.85	Sometimes	Slightly Motivated
3. How often do you find yourself daydreaming during class?	2.80	Sometimes	Slightly Motivated
4. How often do you feel you do not want to participate in class activities?	2.50	Seldom	Moderately Motivated
5. How often do you feel like you would rather be doing something else instead of learning?	2.45	Seldom	Moderately Motivated
6. How often do you feel like the topics covered in class are not important or relevant to your life?	2.50	Seldom	Moderately Motivated
7. How often do you feel like you are not making progress in your learning?	2.80	Sometimes	Slightly Motivated
8. How often do you feel like you are not good at the subject you are learning?	3.30	Sometimes	Slightly Motivated
9. How often do you feel like you cannot learn what is being taught?	2.80	Sometimes	Slightly Motivated
Overall	2.82	Sometimes	Slightly Motivated

It is crucial to consider the broader context in which these students are learning. Factors such as the learning environment, teaching methods, curriculum relevance, and peer interactions can significantly influence students' motivation (Deci et al., 1991). Motivation can be classified into intrinsic (internal) and extrinsic (external). A "Sometimes motivated" score may suggest that these students might

not always find inherent satisfaction or enjoyment in their studies and might be relying on external factors like grades or rewards to stay engaged. (Ryan & Deci, 2000) Students' belief in their abilities (self-efficacy) plays a vital role in motivation. If these lower percentile ranking students feel they are not good at the subject, it can decrease motivation. Educators should work on enhancing students' self-efficacy through appropriate feedback and support (Bandura, 1994).

Boredom and interest are closely related to motivation. If students are occasionally bored or uninterested, it may indicate that the teaching methods or content are not sufficiently engaging or relevant to their interests. Adapting teaching strategies to cater to students' interests can help improve motivation. (Ainley et al., 2002). Identifying students with inconsistent motivation is an opportunity to provide targeted support and interventions. Schools can implement programs like mentoring, tutoring, or counseling to address the specific needs of these students and boost their motivation levels. (Fredricks et al., 2004). Understanding students' motivation levels is crucial because motivation is intricately linked to academic success and long-term achievement. If these lower percentile ranking students remain only "Sometimes motivated," it could impact their future educational and career prospects (Eccles & Wigfield, 2002).

The survey's results reveal a nuanced picture of the motivation levels among lower percentile ranking students, highlighting the need for targeted interventions and a comprehensive approach to improving their motivation and overall academic performance.

On the Level of Motivation of Lower Percentile Ranking Students in the Grade 11 STEM Class in GCCNHS after the Use of the ARCS Model

Table 2 presents the level of motivation of the learners after the use of the ARCS model. It illustrates question number 2. Here, the survey results show that the average level of motivation for the lower percentile ranking students was 3.97, classified as "Moderately motivated." It means the students were more motivated after using the ARCS model but still not consistently motivated.

The ARCS model, developed by John M. Keller, focuses on four key components to enhance motivation in learning: Attention, Relevance, Confidence, and Satisfaction. The improvement in motivation among lower percentile ranking students suggests that implementing this model positively impacted their engagement and interest in the subject matter (Keller, 2016). A classification of "Moderately motivated" implies that there has been a noticeable improvement in motivation levels. However, the fact that students are not classified as "Highly

motivated" suggests that there is still room for further enhancement (Wigfield & Cambria, 2010).

Table 2. *Level of Motivation of the Learners After the Use of the ARCS Model*

Indicators	Mean	Description	Interpretation
1. How often do you feel like you are not interested in the topic being covered in class?	1.95	Seldom	Moderately Motivated
2. How often do you feel bored when you are in class?	1.95	Seldom	Moderately Motivated
3. How often do you find yourself daydreaming during class?	2.45	Seldom	Moderately Motivated
4. How often do you feel you do not want to participate in class activities?	1.60	Never	Very Motivated
5. How often do you feel like you would rather be doing something else instead of learning?	2.45	Seldom	Moderately Motivated
6. How often do you feel like the topics covered in class are not necessary or relevant to your life?	1.95	Seldom	Moderately Motivated
7. How often do you feel like you are not making progress in your learning?	2.10	Seldom	Moderately Motivated
8. How often do you feel like you are not good at the subject you are learning?	2.05	Seldom	Moderately Motivated
9. How often do you feel you cannot learn what is being taught?	2.15	Seldom	Moderately Motivated
Overall	2.07	Seldom	Moderately Motivated

The mention of students not being "consistently motivated" highlights the dynamic nature of motivation. Motivation can fluctuate depending on numerous factors, including instructional methods, course content, and individual student experiences. It underscores the need for ongoing efforts to sustain and bolster motivation throughout the learning process (Urdan & Schoenfelder, 2006). It is essential to consider the potential long-term impact of this moderate level of motivation. Research has shown that sustained motivation is associated with

improved learning outcomes and academic success (Gottfried et al., 2017). Therefore, applying motivational strategies like the ARCS model may lead to even better results over time.

The implementation of the ARCS model appears to have positively influenced the motivation of lower percentile ranking students, although there is room for further improvement. Monitoring and adjusting instructional approaches based on ongoing assessments of motivation can be vital in helping students remain engaged and motivated in their learning.

On the Test of Significant Difference in the Motivation Level of Lower Percentile Ranking Students in Grade 11 STEM Class in GCCNHS after the Implementation of the ARCS Model

Table 3 shows the results of a t-test to determine if there is a statistically significant difference in the motivation level of lower percentile ranking students in Grade 11 STEM class in GCCNHS before and after implementing the ARCS Model.

Table 3. *Test of Difference in the Respondents' Motivation (before and after the use of the ARCS Model)*

Indicators	Pre	Post	t value	p-value
1. How often do you feel like you are not interested in the topic being covered in class?	3.35	1.95	6.658	.000
2. How often do you feel bored when you are in class?	2.85	1.95	5.107	.000
3. How often do you find yourself daydreaming during class?	2.80	2.45	1.789	.090
4. How often do you feel like you do not want to participate in class activities?	2.50	1.60	3.327	.004
5. How often do you feel like you would rather be doing something else instead of learning?	2.45	2.45	.000	1.000
6. How often do you feel like the topics covered in class are not important or relevant to your life?	2.50	1.95	1.764	.094
7. How often do you feel like you are not making progress in your learning?	2.80	2.10	2.208	.040
8. How often do you feel like you are not good at the subject you are learning?	3.30	2.05	4.626	.000

9. How often do you feel like you cannot learn what is being taught?	2.80	2.15	2.371	.028
Overall	2.82	2.07	4.820	.000

The t-test results show that there is a statistically significant difference in the motivation level of the students ($t(44) = 6.658$, $p < .001$). This means that the mean motivation level of the students after the implementation of the ARCS Model is significantly higher than the mean motivation level of the students before the implementation of the ARCS Model.

The effect size of the difference in motivation level is large ($r = 0.75$). Explains that the difference in motivation level is large enough to be considered significant.

The expected increase in student motivation is consistent with the principles of Self-Determination Theory (SDT) proposed by Deci and Ryan (2000). SDT posits that individuals are motivated when they perceive their activities aligned with their basic psychological needs for autonomy, competence, and relatedness. The ARCS Model addresses these needs directly by enhancing the relevance of content, boosting learner confidence, and promoting satisfaction with the learning experience (Keller, 2016). Motivation tends to increase when these needs are met, leading to better engagement and learning outcomes.

On the Level of Effectiveness of the ARCS Model as Perceived by the Lower Percentile Ranking Grade 11 students

Valuable insights into the perception of the ARCS Model's effectiveness among lower percentile ranking Grade 11 STEM students at GCCNHS are shown in Table 4.

The average rating of 3.93, categorized as "Moderately effective," indicates that the students found the model beneficial but not highly so. The aspects that received the highest ratings, such as capturing students' attention, using engaging multimedia, and employing interactive teaching methods, reflect the model's strengths in terms of student engagement (Keller, 2016). These findings align with research emphasizing the importance of attention and relevance in motivation (Hidi & Renninger, 2006).

However, lower ratings for making the course easy to follow and relevant to students' interests signal areas where adjustments can be made.

Numerous studies have demonstrated the effectiveness of the ARCS Model in improving motivation and learning outcomes across various educational contexts. Lohr and Palmer (2012) conducted a study that applied the ARCS Model

to an online learning environment. They found that students who experienced instruction designed according to the ARCS Model reported higher motivation and engagement than those in a traditional instructional setting. A study published by Cheng and Yeh (2017) in higher education found that implementing the ARCS Model improved student motivation and performance. Tuan et al. (2019) examined the impact of the ARCS Model in the context of vocational education and found that it significantly increased students' motivation and achievement.

Table 4. *Level of Motivation (before the use of the ARCS Model)*

Indicators	Mean	SD	Desc	QI
Attention				
1. The course materials used captured my attention.	3.45	.605	Agree	Moderately Effective
2. The visuals and multimedia in the course were engaging.	3.90	.641	Agree	Moderately Effective
3. The instructor used engaging teaching methods.	3.80	.834	Agree	Moderately Effective
4. The course was easy to follow.	3.70	.657	Agree	Moderately Effective
Relevance				
5. The course content was relevant to my interests.	4.05	.759	Agree	Moderately Effective
6. The course content was relevant to my future career goals.	4.00	.795	Agree	Moderately Effective
7. The course content applied to real-world situations.	3.45	.510	Neither Agree nor Disagree	Neither Effective nor Ineffective
8. The course content was challenging but not overwhelming.	3.55	.605	Agree	Moderately Effective
Confidence				
9. The course activities helped me feel confident in my ability to learn.	3.35	.489	Neither Agree nor Disagree	Neither Effective nor Ineffective
10. The feedback I received on my work helped me feel	4.00	.795	Agree	Moderately Effective

confident in my understanding of the course material.				
11. The course provided opportunities for me to practice and apply what I learned.	3.50	.607	Agree	Moderately Effective
12. The course helped me develop new skills and knowledge.	4.35	.671	Strongly Agree	Highly Effective
Satisfaction				
13. Overall, I am satisfied with my experience in the course.	4.10	.641	Agree	Moderately Effective
14. The course met my expectations.	3.80	.768	Agree	Moderately Effective
15. The course was well-organized and easy to navigate.	3.45	.510	Agree	Moderately Effective
16. I would recommend this course to others.	4.55	.510	Strongly Agree	Highly Effective
Motivation				
17. The course motivated me to learn.	4.50	.607	Strongly Agree	Highly Effective
18. I was engaged in the course content.	4.60	.503	Strongly Agree	Highly Effective
19. The course activities and assignments were meaningful and relevant.	4.45	.510	Strongly Agree	Highly Effective
20. I felt motivated to complete the course and achieve my learning goals.	3.95	.759	Agree	Moderately Effective
Overall	3.93	.223	Agree	Moderately Effective

As a well-established framework, the ARCS Model is built upon the principles of instructional design and motivational psychology. Its components, such as gaining learners' attention, making content relevant, building learner confidence, and ensuring satisfaction, effectively enhance motivation (Keller, 2016).

Given the theoretical underpinnings of the ARCS Model and the consistent empirical evidence supporting its effectiveness, implementing the Grade 11 STEM class at GCCNHS increased student motivation. The specific t-test results mentioned earlier provide quantitative evidence confirming this expectation.

CONCLUSIONS

This study concludes that student motivation is dynamic, which numerous factors, including instructional methods and course content, can influence. The ARCS Model showed promise to enhance motivation, but there's room for further improvement to sustain higher motivation levels. Students' belief in their abilities, interest in the subject matter, and ease of following the course are critical to address for sustained motivation.

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