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# Cooperative problem-based learning enhances motivation in sustainability courses using the music model

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## ABSTRACT

Motivation plays a vital role in education, as it drives the learning process. Cooperative Problem-Based Learning (CPBL), an extension of Problem-Based Learning (PBL), has been shown to enhance critical thinking and increase student motivation, particularly in mechanical engineering education. However, studies examining the motivational impact of CPBL remain limited. The MUSIC Model—comprising Empowerment, Usefulness, Success, Interest, and Caring—offers a structured framework for enhancing student motivation. This study investigates the integration of CPBL and the MUSIC Model within mechanical engineering education. A mixed-method approach using a Sequential Explanatory design was employed, involving students from a public university in Surakarta, Indonesia, who were enrolled in a sustainability-focused course. Quantitative data were collected using questionnaires based on the MUSIC Model, while qualitative data were gathered through semi-structured interviews. Data were analyzed using descriptive statistics in SPSS and the Miles & Huberman method for qualitative analysis. The results indicate that 60–90% of students reported very high motivation across all components. These findings suggest that CPBL not only fosters motivation but also contributes to the development of essential 21st-century skills, better preparing students to face future challenges.

**Keywords:** Motivation, Cooperative Problem-Based Learning, MUSIC Model, Mechanical Engineering Education, 21st Century Skills.

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## INTRODUCTION

Motivation has become an increasingly relevant topic in the field of education today. Schunk, Pintrich, dan Meece (2013) define motivation as "the process by which goal-oriented activities are initiated and sustained." Motivation is a key determinant of human behavior; in the academic context, it plays a critical role in the teaching and learning process (Shemy & Dalioglu, 2023). According to Oemar Hamalik, (2009) learning motivation holds an essential place in the learning process. Therefore, the principles that drive learning motivation are closely linked to the fundamental principles of learning itself. Without strong motivation, students often struggle to achieve their academic goals and may fail to remain engaged in the learning process. (Schunk et al., 2013).

Problem-Based Learning (PBL) has been recognized as an effective pedagogical approach to enhancing critical thinking skills, creativity, and teamwork. This is supported by the findings of Rofi'ud Darojatin Nisaa (2023) who suggests that PBL can significantly improve student motivation. Similarly, Wagiran, (2007) also demonstrated that PBL effectively increases student engagement. PBL enables students to actively participate in the learning process by addressing real-world problems that are relevant to the challenges they may encounter in their future professional careers.

Problem-Based Learning (PBL) is typically implemented in small groups, yet it emphasizes the development of individual abilities to think independently and reflectively (Barrows, 1996). Due to its focus on individual capability, PBL has certain limitations, which have led to the emergence of an innovation known as Cooperative Problem-Based Learning (CPBL). According to Yusof et al., (2012) CPBL is a learning approach that integrates Problem-Based Learning (PBL) with Cooperative Learning (CL). This hybrid model is designed to leverage the strengths of both approaches within a unified framework, emphasizing cooperation, face-to-face interaction, individual accountability, and positive interdependence among group members (Johnson et al., 1998). CPBL underscores the importance of linking learning to real-world contexts, enabling students to recognize the practical relevance of classroom content (Savery, 2015) CPBL is particularly relevant in engineering education, especially in mechanical engineering, as it provides authentic, real-world learning experiences. Students are required to solve technical problems and collaborate in teams to achieve shared goals.

Although CPBL has been acknowledged as an effective model for enhancing learning relevance and student engagement, most existing research has primarily focused on its impact on motivation. However, there is limited understanding of how motivational factors function within CPBL, presenting a gap in the literature that warrants further investigation.

As motivation theory continues to evolve, Jones (2009) introduced the MUSIC Model as an effective framework for analyzing and enhancing student motivation in educational settings. The model consists of five key components that influence motivation: Empowerment, Usefulness, Success, Interest, and Caring. Each component contributes to creating a supportive learning environment that encourages deeper student engagement. It is anticipated that by applying the MUSIC Model within CPBL, the effectiveness of this approach in fostering student motivation can be further enhanced.

Therefore, this study aims to explore the synergy between Cooperative Problem-Based Learning (CPBL) and the MUSIC Model of Motivation developed by Jones, in order to identify the key factors influencing student motivation and to offer new insights into enhancing learning motivation through contextual and meaningful instruction, grounded in evaluation outcomes. By conducting an in-depth analysis of the interaction between CPBL and the MUSIC Model, this

research is expected to make a significant contribution to improving the quality of education. Ultimately, the study seeks to analyze student motivation within the framework of the MUSIC Model as a basis for implementing the CPBL approach effectively.

## METHOD

### 1. Research Model

This study employs a Sequential Explanatory Mixed Methods design, consisting of two distinct phases. In the first, quantitative phase, data were collected and analyzed using questionnaires. In the second, qualitative phase, interviews were conducted to validate and enrich the findings from the quantitative data. (Creswell, 2009)

### 2. Research Subjects

The subjects of this research were third-year students of the Mechanical Engineering Education program at a public university in Surakarta (n = 79), consisting of 12.66% women and 87.34% men. The quantitative sample was selected using a survey method involving 45 students, while the qualitative sample was selected through purposive sampling to identify respondents capable of providing in-depth information.

### 3. Data Collection

Quantitative data were collected using a questionnaire based on the MUSIC model, utilizing a 6-point Likert scale (Jones, 2012). The five measured components were empowerment, usefulness, success, interest, and caring. The questionnaire was translated into Indonesian by a certified translator. Qualitative data were obtained through semi-structured interviews, which allowed for the emergence of new questions based on participants' responses and enabled deeper exploration during the interview process (Alijoyo et al., 2018). The interviews followed the interview guide Jones (2012) developed, focusing on the usefulness, success, interest, and care of lecturers and other students.

Table 1. Interview Guide

| | |
|---|---|
| Usefulness | How useful do you find this course for your goals this year or in the future? In what ways is this helpful activity? |
| Success | *How successful do you think you will be in this course? (If necessary): Why?* |
| Situational Interest | How interested are you in working on this course? (How much do you enjoy this course?) What specifically interests you about this activity? |
| Individual Interest | How important is this course to you? Why is it important? |
| Academic Caring from the Lecturer | How much does your lecturer want you to succeed in this course? (How much does your lecturer enjoy helping you with this course?) How do you know? |
| Personal Caring from the Lecturer | How much does your lecturer care about you? How do you know? |

| | |
|---|---|
| Academic Caring from Other Students | How much do other students want you to succeed in this course? How do you know? |
| Personal Caring from Other Students | How much do other students care about you? How do you know? |

**4. Data Analysis Technique**

Quantitative data were analyzed using descriptive statistics, including mean, standard deviation, and median. Following the categorization by Azwar, (2013) the results were classified into five levels: very low, low, medium, high, and very high. Qualitative data were analyzed using the model proposed by Miles et al (2014), which consists of data collection, data reduction, data display, and conclusion drawing. Data from both methods were integrated to provide a comprehensive understanding of student motivation in the context of problem-based learning.

## RESULTS AND DISCUSSION

This section presents the findings obtained through questionnaires and interviews. The study aims to explore students' learning motivation resulting from the implementation of Cooperative Problem-Based Learning (CPBL) in a composite materials course. The collected data were analyzed using quantitative descriptive methods, including analyses of the mean, median, total score, frequency, minimum and maximum values, range, and standard deviation. A detailed explanation of the results is provided below:

Table 2. Descriptive Statistics

| Descriptive Statistics | | | | | | |
|---|---|---|---|---|---|---|
| | N | Range | Minimum | Maximum | Mean | Std. Deviation |
| Empowerment | 45 | 10,00 | 20,00 | 30,00 | 24,4667 | 2,11703 |
| Usefulness | 45 | 10,00 | 20,00 | 30,00 | 24,6667 | 2,30612 |
| Success | 45 | 8,00 | 16,00 | 24,00 | 19,9333 | 2,01585 |
| Interest | 45 | 15,00 | 21,00 | 36,00 | 29,4889 | 3,05720 |
| Caring | 45 | 9,00 | 27,00 | 36,00 | 31,8889 | 2,37623 |
| Valid N (listwise) | 45 | | | | | |

1. Empowerment

The tendency of the data related to the empowerment aspect can be identified using the Ideal Mean (Mi) and Ideal Standard Deviation (SDi), which are 17.5 and 4.16, respectively. The results of the analysis for the Empowerment category are as follows:

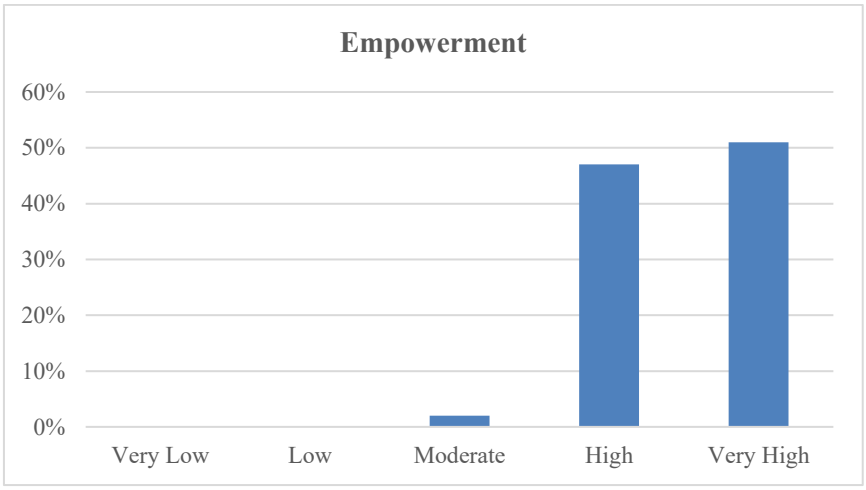


Figure 1. Empowerment

The pie chart indicates that 16 students (36%) fall into the high empowerment category, while 29 students (64%) are categorized as very high. No students were recorded in the other categories, which account for 0%.

2. Usefulness

The distribution of data in the usefulness aspect can be analyzed using the Ideal Mean (Mi) and Ideal Standard Deviation (SDi), which are 17.5 and 4.16, respectively. Based on these values, the results of the usefulness category analysis are as follows:

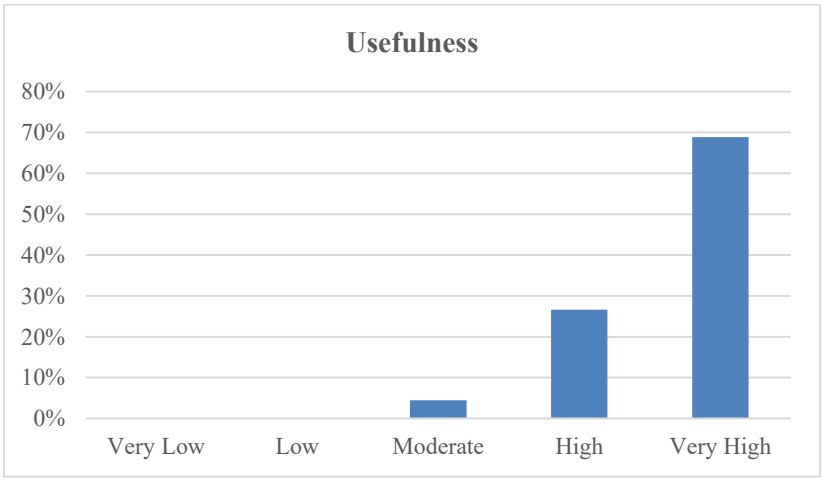


Figure 2. Usefulness

Based on the pie chart, it can be observed that 12 students (27%) fall into the *high* empowerment category, 31 students (69%) are in the *very high* category, 4% are categorized as *moderate*, and none (0%) are in the *low* or *very low* categories.

3. Success

The distribution of data related to the *success* aspect can be analyzed using an Ideal Mean (Mi) of 14 and an Ideal Standard Deviation (SDi) of 3.3. Based on these values, the results can be calculated and classified as follows:

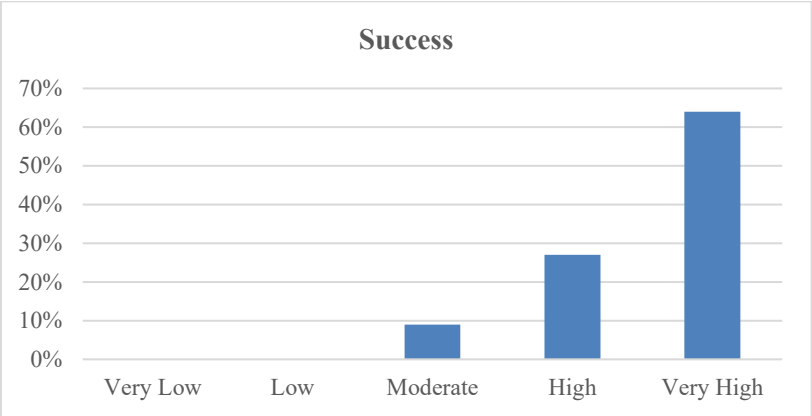


Figure 3. Success

The pie chart indicates that 12 students (27%) fall into the high success category, 29 students (64%) are in the very high category, 4 students (9%) are in the moderate category, while the low and very low categories account for 0% of the participants.

4. Interest

The distribution of data for the *interest* aspect can be interpreted using an Ideal Mean (Mi) of 21 and an Ideal Standard Deviation (SDi) of 5. Based on these values, the results can be calculated and categorized as follows:

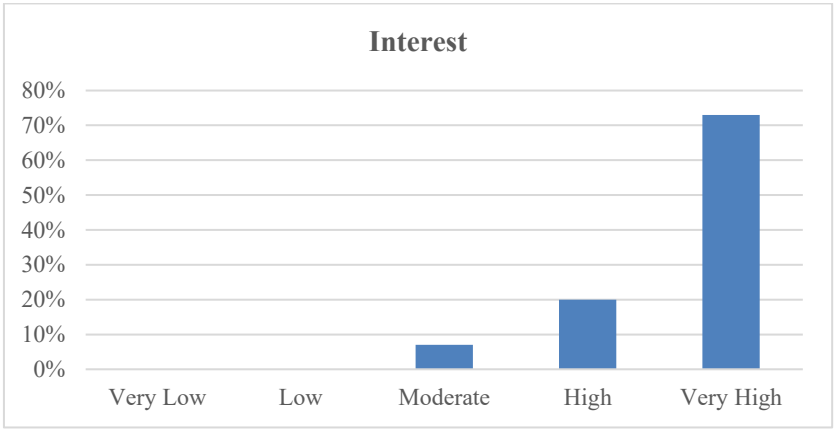


Figure 4. Interest

The pie chart indicates that 9 students (20%) fall into the *high* interest category, 33 students (73%) are in the *very high* category, and 3 students (7%) are in the *moderate* category. The *low* and *very low* categories account for 0%.

5. Caring

The distribution of data for the *caring* aspect can be analyzed using the Ideal Mean (Mi) of 21 and the Ideal Standard Deviation (SDi) of 5. Based on these values, the results can be calculated and classified using the following formula:

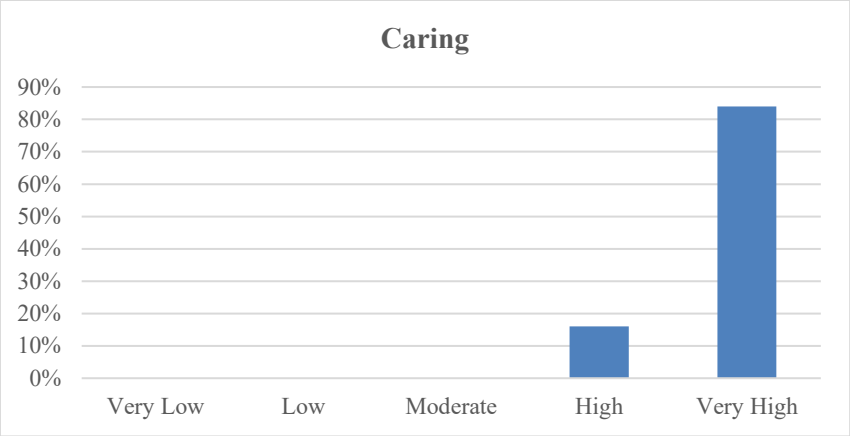


Figure 5. Caring

The pie chart shows that seven students (16%) fall into the high Caring category, while 38 students (84%) are in the very high category. The moderate, low, and very low categories account for 0%. Following the interviews conducted with seven students, a qualitative descriptive analysis was carried out to support and deepen the quantitative findings. This qualitative approach aims to provide a more comprehensive understanding of students' perceptions regarding the five components of the MUSIC Model, as proposed by Jones.

1. Empowerment

Empowerment can help students develop independent decision-making skills related to their learning, such as choosing appropriate learning strategies or managing their time autonomously. This, in turn, can enhance their confidence in their ability to achieve success. Therefore, the CPBL method was implemented in this study to examine whether students felt empowered. Based on the interview results, students reported having the freedom to determine their own learning approaches. As Respondent 1 stated:

*"I also feel free because, aside from focusing on the problem given for us to analyze, I also study beyond that issue. For example, I look for related sources. So, essentially, it gives me more freedom."*

This was also expressed by Respondent 2:

"*Well, in terms of control, I think it's free. The only limitation is from the company; for example, at Integriko, we're restricted to certain things, but for plastics, it's more flexible and not*

*categorized strictly. So, it's more enjoyable that way. We have the freedom to find materials and tools to be used in the manufacturing process for composites."*

Another respondent, Respondent 7, further emphasized this:

*"In terms of freedom, especially towards the end when we were given more projects. The instructor left everything up to the students, so we were asked to think independently and were given projects. Initially, we were challenged with a problem to replace a material, and it was entirely up to us to think about selecting the material ourselves."*

Based on the interview results, it can be concluded that students feel empowered in the learning process, primarily through the CPBL method. They are able to choose learning strategies that align with their individual needs, including the selection of resources, materials, and tools. This autonomy enhances their ability to make independent learning decisions. This is reflected in the responses of Participants 1, 2, and 7, who emphasized that they had full control over completing the assigned tasks and projects, which allowed them to feel more independent and flexible throughout the learning process.

2. Usefulness

The *Usefulness* component of the MUSIC Model (Jones) plays a vital role in fostering student motivation, as it enables students to perceive the relevance of the material being studied in relation to their long-term goals, whether in their careers or personal lives. When students recognize the benefits of what they are learning, they are more likely to be motivated and actively participate in the learning process. The perceived relevance of the material to real-world applications or future career paths provides a strong incentive for students to persist and engage more deeply with the content, thereby enhancing both their motivation and learning outcomes. This aspect of usefulness was highlighted by Participant 4.

*"For composites, this is very useful for me in the future, as over time, waste will continue to accumulate, and composites can add value to waste by transforming it into new products, such as puffing blocks."*

A similar sentiment was expressed by Respondent 6:

*"It turns out to be quite important and can serve as added value when applying to certain companies, as we gain an understanding of how things work. It's very useful because many jobs require knowledge of combinations like composites, making it both helpful and in demand in specific industries."*

This was further reinforced by Respondent 5:

*"Also, when working in a company later, many tasks will be related to composites. So, this material gives me insights for when I join a company—if the company deals with composites, it would be a great advantage."*

Based on the interview results, it can be concluded that students perceive the material related to composites as highly relevant to real-world challenges and their future careers.

3. Success

When students feel successful or confident in their ability to master the material, they are more likely to remain motivated, persist in their efforts, and actively engage in the learning process. This sense of achievement enhances their self-confidence, encouraging them to take on academic challenges. As a result, success fosters a positive cycle that reinforces both motivation and learning outcomes. This theme was evident in the interviews, as Respondent 2 remarked:

*" I am very confident that I can handle the composite project. For the project, I have already researched, checked out tools, and looked for journals and references from various sources. I believe it's very possible to accomplish and create the composite."*

Respondent 6 also shared a similar sentiment:

*" Yes, I feel successful because the control is in the hands of the students, so we have no choice but to read articles, filter the information, and discuss it again. There are many things we've learned during the composite course."*

Respondent 7 further emphasized:

*" I'm confident because our group has already gathered many references from journals. We've made the mixture as best as possible. Confidence also comes from my group members, who are quite cooperative in working on the project. Another factor is the guidance from the supervising lecturer, who helps direct us toward the proper goals."*

These interview responses indicate that students have developed a strong sense of confidence in their ability to succeed. When they feel capable of mastering the material—such as in the composite project—their confidence increases, further motivating them to continue learning and striving for excellence.

4. Interest

High interest in learning materials encourages active engagement and enthusiasm in the learning process. When students are genuinely interested in the topics they are studying, they tend to concentrate more, put in greater effort, and find the learning experience more enjoyable. The following excerpts from interviews illustrate students' interest. According to Respondent 6:

*" I'm quite interested because, at first, I didn't know what composites were, so I was curious about what composites actually are. That's why I chose composites as my elective course."*

Similarly, Respondent 4 expressed:

*" I find it quite interesting, but just quite interesting, because the materials and assignments are based on real-world problems."*

This was also supported by Respondent 1, who stated:

*" So, it's quite important because of my interest. I'm interested in material science; coincidentally, there's a composites course. So, this composites course has become something quite important for me."*

Based on the interview results, it can be concluded that student's interest in the composites course is driven by curiosity and the relevance of the material to real-world problems.

5. Caring

This sense of caring enhances students' confidence and motivates them to achieve their academic goals. Support, feedback, and attention from lecturers also help students feel valued, which can increase their engagement in learning and strengthen their commitment to successfully completing tasks. The following are interview excerpts related to the caring aspect.

According to Respondent 1:

*" The lecturers monitor the students' work—whether it's correct, whether it needs revision, or if more data is required. So, in my opinion, they support their students and help them succeed in the composites course."*

*"I feel that other students care about me very much. For example, in the WhatsApp group, there were times when I forgot or didn't have time to do something. Other students would remind me, which made me feel that my peers care about me in this composites course."*

Respondent 7 also shared:

*" The way they (the lecturers) deliver the material is good, and we are always guided through every step and stage of the project. So, I can see that the lecturers want the best for us in this course."*

*"As for caring, my group members are quite close, so they care about me, and I care about them too. We remind each other about tasks and encourage each other to work together."*

Respondent 5 expressed a similar sentiment:

*" The lecturers, in my opinion, were very helpful because they asked about our progress. Based on that progress, the lecturer can gauge how much the students know and what areas need improvement. This is helpful for both the lecturer and the students, as it helps identify gaps that can be addressed."*

Respondent 3 reinforced this:

*" In the composites class, the lecturer posed questions to each group. If a group was not actively participating, the lecturer would inquire about the difficulties they were facing—for instance, whether they had identified the appropriate manufacturing process or selected the correct matrix."*

Based on the interviews, it can be concluded that the sense of care demonstrated by both lecturers and fellow students plays a significant role in enhancing students' motivation and engagement in the learning process. Support from lecturers—through progress monitoring, constructive

feedback, and continuous guidance—helps students feel supported and valued throughout their educational journey.

The implementation of Problem-Based Learning (PBL), including its cooperative form (CPBL), in engineering education has received considerable attention. This approach has gained traction in recent years, as engineering students are increasingly expected to be equipped for the complex challenges of the modern world. Using the MUSIC model, this study examined the impact of Cooperative Problem-Based Learning (CPBL) on student motivation in engineering classrooms (Jones, 2009b). The key components of the MUSIC model include empowerment, usefulness, success, interest, and caring.

The quantitative and qualitative findings of this study revealed that student responses for each MUSIC component ranged from high to very high. This suggests that the implementation of CPBL can significantly enhance student motivation. Introduced by (Yusof et al., 2012b). CPBL is a valuable method that fosters an active learning environment. It promotes both technical and non-technical competencies, aligning well with the demands of engineering education.

The results further revealed a particularly high level of empowerment among students engaged in CPBL. Empowerment is a critical factor, as it encourages student responsibility, fosters a sense of ownership in the learning process, and motivates students to tackle complex problems. This finding is consistent with previous research indicating that PBL can enhance student responsibility, self-regulated learning, and a sense of belonging by actively involving students in classroom activities Karl et al. (2005) Mary & Anastasia (2013). While many students initially expressed frustration during early CPBL sessions—due to the complexity of the problems, which differed from their previous experiences in traditional face-to-face learning—most students reported feeling more confident and encouraged by the end of the CPBL cycle, having successfully solved complex problems.

The usefulness of learning materials is another critical component of motivation in the MUSIC model. Students need to recognize that the materials are relevant and valuable for their future. The findings of this study indicated that the perceived usefulness of the materials was rated at a very high level. Students reported that the content studied in the Sustainability Composite Materials course was both helpful and relevant to current industry demands and their future careers. Previous research by Nariman, (2021) emphasized that PBL methods align with industry practices, thereby enhancing the perceived usefulness and relevance of students' learning experiences in relation to their career interests. Furthermore, incorporating real-world problems from industry settings ensures that the learning tasks are both academically and professionally meaningful for students (Graaf,2003).

The success component is also a key motivational factor in the MUSIC model, wherein students believe they are capable of performing complex tasks. The findings revealed that students

reported high to very high levels of perceived success. They were able to solve complex problems presented during the CPBL implementation. This sense of success contributed to an increase in their self-confidence. Previous studies have shown that PBL approaches can enhance student achievement and confidence. By structuring each PBL cycle clearly, providing regular feedback, and implementing ongoing assessments, students' understanding gradually improves, which in turn boosts both their knowledge and confidence (Al-Madi et al., 2018)

Success in learning often occurs when students are genuinely interested in the subject matter. Interest is a key component of the MUSIC model, as strong intrinsic interest can motivate students to enjoy and engage in learning activities. The findings of this study indicate that students demonstrated very high levels of interest, suggesting strong motivation to learn about sustainability and composite-related topics. This intrinsic motivation can be a powerful internal driver for overcoming challenges encountered during the implementation of CPBL. Previous research has shown that engineering students are more likely to engage in learning when they understand the relevance of the content to real-world social needs and global challenges (Litzinger et al., 2011)

The Caring component of the MUSIC model encompasses students' perceptions of being supported in their learning environments, particularly by their peers and instructors. Within the CPBL approach, cooperative learning strategies are employed to foster teamwork, enhance communication, and create a supportive classroom atmosphere. The results of this study revealed that students felt supported by both their instructors and peers. This finding aligns with previous research, which emphasizes that effective communication, collaborative teamwork, and a supportive learning environment in CPBL can significantly enhance student engagement in addressing complex problems (Gwee, 2008).

## CONCLUSION

This study explores the implementation of CPBL in sustainability-related courses to enhance student motivation through the MUSIC model framework. CPBL has been shown to improve student motivation across the dimensions of empowerment, usefulness, success, interest, and caring. Instructors must thoughtfully design CPBL strategies to address key challenges, including fostering students' sense of responsibility and belonging in learning, ensuring relevance to current demands and real-world problems, building competence and confidence, promoting student engagement, and supporting a conducive learning environment. These elements are essential in engineering education, as future engineers must be equipped to tackle the complex challenges posed by modern societal needs.

**REFERENCES**

Alijoyo, A., Wijaya, Q. B., & Jacob, I. (2018). *Structured or Semi-structured Interviews*. www.lspmks.-

Al-Madi, E. M., Celur, S. L., & Nasim, M. (2018). Effectiveness of PBL methodology in a hybrid dentistry program to enhance students' knowledge and confidence. (a pilot study). *BMC Medical Education*, *18*(1), 1–6. https://doi.org/10.1186/s12909-018-1392-y

Azwar, S. (2013). *Penyusunan Skala Psikologi Ed 2*. Pustaka Belajar. https://books.google.co.id/books?id=xxm6twaacaaj

Barrows, H. S. (1996). Problem-based learning in medicine and beyond: A brief overview. *New Directions for Teaching and Learning*, *1996*(68), 3–12. https://doi.org/https://doi.org/10.1002/tl.37219966804

Creswell, J. W. (2009). Research design: Qualitative, quantitative, and mixed methods approaches, 3rd ed. In *Research design: Qualitative, quantitative, and mixed methods approaches, 3rd ed.* Sage Publications, Inc.

Graaff, e. De. (2003). Characteristics of Problem-Based Learning. *International Journal of Engineering Education*, *19*(5), 657–662. https://doi.org/10.52842/conf.ecaade.2006.182

Gwee, M. C. E. (2008). Globalization of Problem-based Learning (PBL): Cross-cultural implications. *Kaohsiung Journal of Medical Sciences*, *24*(3 SUPPL.). https://doi.org/10.1016/s1607-551x(08)70089-5

Johnson, D. W., Johnson, R. T., & Smith, K. A. (1998). Cooperative Learning Returns To College What Evidence Is There That It Works? *Change: The Magazine of Higher Learning*, *30*(4), 26–35. https://doi.org/10.1080/00091389809602629

Jones, B. D. (2009a). Motivating Students to Engage in Learning: The MUSIC Model of Academic Motivation. *International Journal of Teaching and Learning in Higher Education*, *21*(2), 272–285. http://www.isetl.org/ijtlhe/

Jones, B. D. (2009b). Motivating Students to Engage in Learning : The MUSIC Model of Academic Motivation. *International Journal of Teaching and Learning in Higher Education*, *21*(2), 272–285.

Jones, B. D. (2012). *User Guide for Assessing the Components of the MUSIC ® Model of Motivation*. www.theMUSICmodel.com

Karl, S. A., Sheppard, S. D., Johnson, D. W., & Johnson, R. T. (2005). Pedagogies of Engagement: Classroom-Based Practices. *Journal of Engineering EDucation*, *January*, 15.

Litzinger, T. A., Lattuca, L. R., Hadgraft, R. G., Newstetter, W. C., Alley, M., Atman, C., DiBiasio, D., Finelli, C., Diefes-Dux, H., Kolmos, A., Riley, D., Sheppard, S., Weimer, M., & Yasuhara, K. (2011). Engineering education and the development of expertise. *Journal of Engineering Education*, *100*(1), 123–150. https://doi.org/10.1002/j.2168-9830.2011.tb00006.x

Mary, & Anastasia. (2013). Supporting Student Self-Regulated Learning in Problem- and Project-Based Learning. *Interdisciplinary Journal of Problem-Based Learning*, *7*(2), 127–150.

Miles, M. B., Huberman, A. M., & Saldana, J. (2014). *Qualitative Data Analysis*. SAGE Publications. https://books.google.co.id/books?id=3CNrUbTu6CsC

Nariman, N. (2021). How Does an Industry-aligned Technology-rich Problem-based Learning (PBL) Model Influence Low-income and Native Hawaiian Student's STEM Career Interest? *Journal of Problem Based Learning in Higher Education*, *9*(1 Special Issue), 150–178. https://doi.org/10.5278/ojs.jpblhe.v9i1.6367

Oemar Hamalik. (2009). *Perencanaan Pengajaran Berdasarkan Pendekatan Sistem* (8th ed.).

Rofi'ud Darojatin Nisaa, & Putu Abda Ursula. (2023). Implementasi Problem Based Learning Untuk Meningkatkan Motivasi Belajar Psikologi Abnormal Pada Mahasiswa Semester Iv Program Studi Bimbingan Dan Konseling. *E-Journal Universitas Panji Sakti*, *10*(1). https://doi.org/https://doi.org/10.37637/dw.v10i1.1388

Savery, J. R. (2015). Overview of problem-based learning : definitions and distinctions. In A. Walker, H. Leary, & C. E. Hmelo-Silver (Eds.), *Essential readings in problem-based learning*. Purdue University Press.

Schunk, D. H., Meece, J. L., & Pintrich, P. R. (2013). *Motivation in Education: Theory, Research and Applications*. Pearson. https://books.google.co.id/books?id=QUo5nwEACAAJ

Shemy, N. S., & Dalioglu, S. T. (2023). The MUSIC model of motivation: Its utilization in the e-learning context and graduate students' perceptions of its effectiveness. *Journal of Education and E-Learning Research*, *10*(2), 147–153. https://doi.org/10.20448/jeelr.v10i2.4486

Wagiran. (2007). Peningkatkan Keaktifan Mahasiswa Dan Reduksi Miskonsepsi Melalui Pendekatan Problem Based Learning. *Fakultas Teknik: Universitas Negeri Yogyakarta*.

Yusof, K. Mohd., Hassan, S. A. H. S., Jamaludin, M. Z., & Harun, N. F. (2012a). Cooperative Problem-based Learning (CPBL): Framework for Integrating Cooperative Learning and Problem-based Learning. *Procedia - Social and Behavioral Sciences*, *56*, 223–232. https://doi.org/10.1016/j.sbspro.2012.09.649

Yusof, K. Mohd., Hassan, S. A. H. S., Jamaludin, M. Z., & Harun, N. F. (2012b). Cooperative Problem-based Learning (CPBL): Framework for Integrating Cooperative Learning and Problem-based Learning. *Procedia - Social and Behavioral Sciences*, *56*(Ictlhe), 223–232. https://doi.org/10.1016/j.sbspro.2012.09.649