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Hybrid Learning's Impact on Engineering Students' Motivation and Achievement

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Recognizing motivation as a key element significantly contributes to students' success in higher education. Specifically, motivation in learning greatly influences their adaptation to the academic demands and expectations of this level. This study aims to evaluate the effect of hybrid learning on motivation and learning achievement among engineering students enrolled in multimedia and animation courses. The research employs a quasi-experimental design, comprising experimental and control groups. One group utilizes conventional face-to-face learning, while the other adopts hybrid learning. Each group consists of 25 randomly sampled students from the informatics engineering program. The data collection process involves administering a questionnaire to assess motivation, adapted from Martin (2001), alongside exam assessments. The results indicate a significant difference in motivation ($p = 0.024 < \alpha = 0.050$) and learning achievement ($p = 0.033 < \alpha = 0.050$) between the two groups. Furthermore, Pearson correlation analysis revealed a strong correlation between motivation and learning achievement (Sig. value (2-tailed) $= 0.000 < \alpha = 0.05$). The findings indicate a significant and strong correlation between motivation and learning achievement. Consequently, it can be inferred that an increase in motivation is associated with a corresponding increase in learning achievement, and vice versa. This suggests that hybrid learning can effectively enhance the teaching of animation and multimedia course within the informatics engineering department's curriculum.

Keywords: higher education, blended learning, achievement, motivation.

1. Introduction

Learning is essential aspect of human existence that cannot be separated. Effective learning plays a crucial role in helping students enhance their abilities, aligning with the established objectives during the learning process. Through learning, students can tap into their potentials, enabling them to meet their needs (Dakhi et al. 2022). In a study examining the factors

contributing to students discontinuing higher education (Severiens and ten Dam 2012), three main elements emerged as impacting student persistence, including attributes of learners like motivation and cognitive capabilities. Motivation has been recognized as a crucial factor in both student success and the likelihood of retaining students in higher education. Positive motivation and cognitive dimensions encompass aspects like self-confidence, appreciation, and a focus on learning. Decreased motivation levels have been linked to heightened distress among students (Dyrbye, Thomas, and Shanafelt 2005). Fostering improved motivation to learn may play an additional role in enhancing student well-being. Timely identification of students at risk could aid in the smooth progression for some students transitioning from secondary to higher education. The motivation to learn, particularly self-confidence in learning, may exert a significant influence during the transition to higher education. It might be appropriate to consider personalized follow-up for students entering with lower motivation levels (Edgar et al. 2019).

Technology could play a role in boosting students' motivation for STEM (Science, Technology, Engineering, and Mathematics) subjects, although the impact may vary based on the type of schools (Ibáñez et al. 2020). The integration of technological tools in educational settings can make learning more interactive, dynamic, and relevant, catering to the digital inclinations of today's students. Interactive simulations, multimedia resources, and collaborative online platforms can enhance the overall learning experience and, in turn, contribute to increased motivation. The progress in Information and Communication Technology (ICT) is advancing so rapidly that experts rightly label it as a revolution. In relation to this, education is currently undergoing a rapid revolution, and traditional learning methods are no longer the sole focus. With technological advancements, diverse learning methods are essential, offering more opportunities for learning by utilizing various sources beyond human resources, such as teachers. The emergence of technology-based learning concepts, exemplified by the concept of e-learning, has laid the groundwork for further advancements in education (Sari et al., 2023). Building upon this foundation, the concept of hybrid learning has evo[1]lved, seamlessly integrating traditional face-to-face instruction with online and digital elements. In this progression, e-learning serves as the precursor, emphasizing digital platforms for educational content. Hybrid learning, on the other hand, takes this a step further, blending both traditional and digital methods to create a more flexible and dynamic educational experience. Thus, the connection between e-learning and hybrid learning is evident in the seamless incorporation of digital elements into the broader landscape of education.

The idea of e-learning and blended learning in the Indonesian education system is not a new phenomenon; even international standard schools have adopted these methods for student learning (Putra and Triastuti 2019). The implementation of these concepts is facilitated by students' familiarity with technology, as the basic principles of e-learning closely align with their daily lives (Damuri et al. 2021). Moreover, teachers in these schools are generally of high quality and possess proven capabilities in various teaching methods (Priska et al., 2020), making the application of these concepts relatively straightforward. However, challenges arise when considering students who are distant from technological access, lack proper knowledge

of technology as a learning resource, and unfortunately, constitute a significant portion of the student population in Indonesia. Urgent solutions are necessary, as these students represent the future generation of the nation and will need to navigate a world where technological developments evolve rapidly. Therefore, the blended learning method exists to let teachers and students to gradually adapt to educational technology advancements while still incorporating traditional face-to-face methods, providing a balanced approach to address the diverse technological readiness among students.

However, there is a scarcity of research that examines the influence of hybrid learning on student motivation. Among the researchers who have explored this area, Islam et al. (2018) and Wong et al. (2020) stand out. Islam et al. (2018) revealed that although blended learning may not have a significant impact on student achievement, its influence on student motivation is notable. Their study indicates that students exposed to a blended learning environment exhibit higher motivation compared to those in a traditional direct learning setting. Similarly, Wong et al. (2020) reported beneficial impacts in both learner autonomy and students' motivation constructs in hybrid learning compared to traditional face-to-face instruction. These findings suggest that while the impact on academic achievement may vary, blended learning appears to positively influence student motivation, as evidenced by increased autonomy and motivation in comparison to traditional learning methods.

STMIK Royal, a distinguished private educational institution, serves as a model for schools with a strong commitment to education. Within its academic offerings, the Department of Informatics Engineering stands out as a major that plays a vital role in producing professional graduates capable of meeting community needs, particularly in information technology programs. This department contributes significantly to the development of Indonesia, with a specific focus on North Sumatra Province, Indonesia. In the pursuit of academic excellence, it has come to light through interviews with several students that there is a noteworthy challenge related to low motivation. Additionally, observations by researchers indicate a lack of preparation among students, evident in their tendency to arrive late for classes. This issue of punctuality and apparent low motivation underscores the importance of implementing effective strategies to address and enhance student engagement and motivation in multimedia and animation courses. The proposed approach involves leveraging blended learning, providing students with a flexible and dynamic educational experience. This introduction sets the stage for an exploration of the challenges encountered by students and the possible advantage of adopting hybrid learning in this academic setting. Hence, this study aims to assess the effect of hybrid learning on students' learning motivation and achievement, specifically focusing on multimedia and animation course.

2. Methodology

This study used a pre-experimental design method, which is often referred to as a "quasi-experiment" as it is not considered a fully controlled experiment (Suharsini, 2006; Yustina et al., 2020). Quasi-experimental research aims to test hypotheses about the effects of actions by comparing them to other actions while controlling variables based on existing situational conditions (Yustina, Syafii, and Vebrianto 2020). The primary goal of this study was to describe and compare the learning motivation of students in the Informatics Engineering Study

Program within a blended learning environment. The study was conducted from April to October 2023, with participants providing informed consent. The study's population comprised of Level III students in the Department of Informatics Engineering at STIMK Royal, class of 2022. Using random sampling, an experimental class of 25 students and a control class of 25 students were formed.

Student learning motivation was assessed using a questionnaire developed from Martin (2001), which utilizes a Likert scale ranging from 1 to 4, consisting of 13 items. The aspects assessed include persistence, self-belief, learning focus, interest, and the value of schooling. Additionally, student achievement was measured through a final exam in multimedia and animation course, consisting of 13 questions with a maximum score of 100. The aspects assessed include: (1); understanding 2D animation basics; (2); presenting fundamental 2D animation principles; (3); creating simple 2D objects; (4); animating simple 2D objects; (5); designing 2D human characters; (6); animating 2D human characters; (7); producing three 2D human characters; (8); animating three 2D human characters; (9); crafting multiple 2D road and house objects; (10); animating multiple 2D road and house objects.

Data were collected through pre-tests and post-tests. Both instruments underwent validity and reliability assessments based on specific criteria. The results of the validity tests indicated that all items on the motivation and learning achievement scale were valid with values greater than the acceptable threshold of robs = 0.553 at a significant value of 0.05. In terms of reliability testing, the Cronbach's Alpha values were 0.771 and 0.867 for the motivation assessment and learning achievement assessment instruments, respectively, indicating that the instruments have a satisfactory level of reliability.

The data analysis encompassed tests for normality and homogeneity on the post-test and pre-test data of motivation and learning achievement from both groups. To ascertain the differences in motivation and learning achievement between the two groups, independent samples t-tests were conducted. Furthermore, to measure the influence of motivation on learning achievement, Pearson correlation was employed. These tests were conducted at a significance threshold of 0.05.

The study is directed by the following research questions:

- Is there any significant difference in student motivation between the two groups?
- Is there any significant difference in student achievement between the two groups?
- Is there any significant correlation between student motivation and achievement?

3. Descriptive Results

Table 1 displays the average student responses regarding learning motivation in the multimedia and animation course. The average scores for both groups in the pre-test were 1.42 and 1.72 for the control group and experimental group, respectively. Meanwhile, in the post-test, both groups experienced an increase in motivation, reaching 1.70 (an increase of 0.28 points) and 2.54 (an increase of 0.82 points) for the control and experimental groups, respectively. This indicates a larger increase in motivation in the control group taught using

blended learning. During the pre-test, students in the control group felt that their commitment to studying multimedia and animation remains steadfast, even outside of examination periods (item No. 12), with the highest score being 2.04. This suggests that students in the control group already exhibited a strong commitment to studying multimedia and animation, regardless of the instructional approach. This pre-existing commitment likely influenced their motivation levels throughout the course, contributing to the observed increase in motivation from pre- to post-test. Meanwhile, in the post-test, this group still achieved the highest score on that item. This indicates that there was no change in student motivation before and after learning in the multimedia and animation course. Meanwhile, in the experimental class, in the pre-test, the highest motivation score was on item No. 11, which states that students approach multimedia and animation classes with consistent enthusiasm. After learning with blended learning, in the post-test, this group also had the highest score on that item, at 3.71. This indicates that students experienced an increase in enthusiasm for attending classes.

Table 1. Mean Responses from Motivation Questionnaire

Item No.	Statements	Mean (SD)			
		Pre-Test		Post-Test	
		Control Group (N=25)	Experimental Group (N=25)	Control Group (N=25)	Experimental Group (N=25)
1	I make an effort to complete multimedia and animation assignments on time.	1.16 (0.374)	1.36 (0.700)	1.60 (0.816)	2.40 (0.764)
2	If there are multimedia and animation technology assignments or homework, I immediately work on them after class.	1.36 (0.638)	1.60 (1.041)	1.44 (0.583)	2.89 (1.150)
3	Even if I receive low grades, I will not give up or lose hope in learning multimedia and animation.	1.56 (0.712)	2.64 (1.469)	1.76 (0.926)	2.56 (1.474)
4	I will persist and study harder when I receive satisfactory grades.	1.76 (0.926)	2.16 (0.987)	1.80 (0.913)	2.24 (0.926)
5	If I encounter difficult questions in multimedia and animation, I will strive to find the answers.	1.48 (0.823)	1.32 (0.748)	1.40 (0.764)	2.83 (0.907)
6	If I have difficulty completing multimedia and animation homework, I will seek answers from various sources.	1.64 (0.810)	2.12 (0.971)	1.88 (1.092)	2.60 (1.000)
7	I feel comfortable seeking clarification when I encounter difficulties while studying multimedia and animation.	1.00 (0.000)	1.04 (0.200)	1.68 (0.852)	1.92 (1.003)
8	I am interested in solving the problems given by the lecturer in multimedia and animation.	1.08 (0.277)	1.04 (0.200)	1.60 (0.866)	1.55 (0.277)
9	I actively focus on the lecturer's explanations during the multimedia and animation course.	1.00 (0.000)	1.00 (0.000)	1.56 (0.768)	2.59 (0.473)
10	I diligently study multimedia and animation to pave the way for my future aspirations.	1.08 (0.277)	1.04 (0.200)	1.52 (1.005)	2.69 (0.737)
11	I approach multimedia and animation classes with consistent enthusiasm.	1.60 (0.645)	2.72 (1.370)	1.88 (0.781)	3.71 (1.288)
12	My commitment to studying multimedia and animation remains steadfast, even outside of examination periods.	2.04 (0.889)	2.60 (0.866)	2.04 (1.020)	2.78 (0.802)
13	When recognized by a teacher for my achievements in solving multimedia and animation problems, I am further motivated to tackle additional challenges.	1.64 (0.860)	1.56 (0.961)	1.92 (1.077)	2.30 (1.041)
	Mean	1.42	1.72	1.70	2.54

(SD)	(0.311)	(0.450)	(0.484)	(0.477)
Min.	1.00	1.00	1.40	1.55
Max.	2.04	2.72	2.04	3.71

Note: The Likert scale used ranged from Strongly Disagree (1) to Strongly Agree (4).

Table 2 summarizes the learning achievement outcomes of both groups in the multimedia and animation course. In the control class, the greatest increase from pre-test to post-test occurred in task No. 11, which encompasses the aspect of creating animations of three 2D human character objects. Similarly, in the class implementing hybrid learning, the largest improvement also occurred in task No. 11. This may occur because this task may demand a higher level of skill and understanding compared to other tasks. Therefore, students may have invested more effort and focus in mastering this complex task, resulting in greater improvements in learning outcomes.

Table 2. Mean Responses from Learning Achievement

Aspect	Task No.	Mean (SD)			
		Pre-Test		Post-Test	
		Control Group (N=25)	Experimental Group (N=25)	Control Group (N=25)	Experimental Group (N=25)
Understanding the basic principles of 2D animation creation.	1	66.24 (2.127)	67.36 (3.925)	69.60 (3.524)	68.24 (4.146)
	2	67.28 (4.188)	68.96 (4.148)	68.92 (3.628)	70.24 (5.142)
	3	71.52 (5.867)	74.24 (8.819)	70.20 (4.301)	75.96 (9.135)
	4	69.24 (3.677)	71.80 (5.000)	69.12 (3.032)	74.52 (6.430)
Presenting the fundamental principles of 2D animation creation.	5	66.36 (1.705)	66.96 (2.965)	68.48 (3.454)	69.40 (4.619)
Creating simple 2D objects.	6	69.68 (4.250)	71.84 (4.516)	73.16 (4.220)	75.52 (5.803)
Creating animations of simple 2D objects.	7	69.60 (5.132)	72.80 (7.141)	72.16 (4.432)	74.88 (6.078)
Creating 2D human character objects.	8	69.92 (3.696)	72.96 (4.228)	72.40 (3.808)	75.00 (4.282)
Creating animations of 2D human character objects.	9	66.96 (3.195)	67.08 (3.265)	68.76 (4.166)	70.44 (6.520)
Creating three 2D human character objects.	10	67.48 (3.203)	69.96 (4.306)	71.00 (4.021)	74.44 (6.513)
Creating animations of three 2D human character objects.	11	67.52 (3.137)	69.20 (3.948)	72.36 (5.283)	73.76 (6.366)
Creating several 2D road and house objects.	12	68.56 (3.595)	70.72 (4.818)	71.28 (3.747)	73.84 (5.728)
Creating animations of several 2D road and house objects.	13	67.52 (3.454)	69.04 (3.813)	69.88 (3.734)	72.04 (5.682)

Mean	68.30	70.22	70.56	72.94
(SD)	(1.588)	(2.388)	(1.594)	2.566)
Min.	66.24	66.96	68.48	68.24
Max.	71.52	74.24	73.16	75.96

Note: Maximum score of learning achievement is 100.

Tables 1 and 2 show the mean values of students' motivation and learning achievement. In the control group, the average motivation score increased from 1.42 before learning to 1.70 after learning, while the average learning achievement score increased from 68.30 to 70.56. On the other hand, the experimental group had higher mean scores in both motivation and learning achievement. Specifically, the average motivation score increased from 1.72 to 2.54, and the average learning achievement score increased from 70.22 to 72.94.

4. Normality and Homogeneity Tests

The normality tests used were the Kolmogorov-Smirnov test and the Shapiro-Wilk test. Table 3 shows the results of normality tests on student motivation and learning achievement data. Based on these results, it was found that all Sig. values > the significance level of 0.05, suggesting that all dataset groups, both from the control and experimental groups, are normally distributed.

Table 3. Results of Normality Tests for Students' Motivation and Learning Achievement

Group	Variable	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Control Group	Motivation Pre-test	.124	25	.200*	.921	25	.054
	Motivation Post-test	.147	25	.170	.925	25	.065
	Learning Achievement Pre-test	.144	25	.191	.929	25	.082
	Learning Achievement Post-test	.194	25	.017	.927	25	.073
Experimental Group	Motivation Pre-test	.122	25	.200*	.961	25	.440
	Motivation Post-test	.135	25	.200*	.952	25	.272
	Learning Achievement Pre-test	.118	25	.200*	.927	25	.073
	Learning Achievement Post-test	.098	25	.200*	.967	25	.564

Note: *This represents the minimum level of significance; [a]significance corrected using Lilliefors method; $p < 0.05$.

The homogeneity tests, presented in Table 4, indicate that the data have homogeneous variances for both the motivation and learning achievement variables. Specifically, the Sig. values based on mean for the pre- and post-test were 0.057 and 0.700, respectively, for motivation, and 0.409 and 0.084, respectively, for learning achievement. These values exceed the significance level, affirming the homogeneity of variances across the dataset.

Table 4. Results of Homogeneity Tests for Students' Motivation and Learning Achievement

Variable	Statistics	Levene Statistic	df1	df2	Sig.
Motivation Pre-test	Based on Mean	3.808	1	48	.057
	Based on Median	3.347	1	48	.074

	Based on Median and with adjusted df	3.347	1	40.547	.075
	Based on trimmed mean	3.821	1	48	.056
Post-test	Based on Mean	.150	1	48	.700
	Based on Median	.206	1	48	.652
	Based on Median and with adjusted df	.206	1	44.953	.652
	Based on trimmed mean	.173	1	48	.679
Learning Achievement					
Pre-test	Based on Mean	.694	1	48	.409
	Based on Median	.694	1	48	.409
	Based on Median and with adjusted df	.694	1	44.761	.409
	Based on trimmed mean	.705	1	48	.405
Post-test	Based on Mean	3.110	1	48	.084
	Based on Median	3.431	1	48	.070
	Based on Median and with adjusted df	3.431	1	43.473	.071
	Based on trimmed mean	3.205	1	48	.080

Note: $p < 0.05$.

5. Independent Sample t-Test

The testing using independent sample t-tests was conducted to answer research questions number 1 and 2, namely, whether there is a substantial difference in student motivation and student learning achievement between the two groups. The data used were the score increases from pre- to post-test in both test groups. Tables 5 and 6 present the results of the independent sample t-tests to address the differences in the motivation and learning achievement variables, respectively.

Table 5. Independent Sample t-Test on Students' Motivation

Statistics	Levene's Test for Equality of Variances		t-Test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	5.441	.024	-2.166	48	.035	-.24120	.11135	-.46508	-.01732
Equal variances not assumed			-2.166	44.128	.036	-.24120	.11135	-.46559	-.01681

Note: $p < 0.05$.

Table 6. Independent Sample t-Test on Students' Learning Achievement

Statistics	Levene's Test for Equality of Variances		t-Test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	4.793	.033	-2.953	48	.005	-2.14960	.72789	-3.61312	-.68608
Equal variances not assumed			-2.953	41.564	.005	-2.14960	.72789	-3.61900	-.68020

Note: $p < 0.05$.

According to Table 5, the significance value (two-tailed) is 0.035, which is less than the set significance threshold of 0.050. Consequently, it can be concluded that there exists a notable disparity in motivation between the control and experimental groups. Similarly, Table 6 displays a significance value (two-tailed) of 0.005, which is below the significance level of 0.050. This suggests a substantial variance in learning achievement between control class and experimental class. Therefore, it can be inferred that hybrid learning has a discernible impact on both motivation and learning achievement among students enrolled in multimedia and animation courses.

6. Pearson Correlation

Table 7 illustrates the findings of the Pearson correlation analysis, which seeks to evaluate the connection between motivation and learning achievement, as part of the third research inquiry. The results reveal a Pearson correlation coefficient of 0.679, indicating a robust association between motivation and achievement. Moreover, the significance level of the correlation between motivation and achievement is underscored by the two-tailed Sig. value of 0.000, falling under the established significance level of 0.050.

Table 7. Pearson Correlation

Variable	Statistics	Motivation	Learning Achievement
Motivation	Pearson Correlation	1	.679**
	Sig. (2-tailed)		.000
	N	50	50
Learning Achievement	Pearson Correlation	.679**	1
	Sig. (2-tailed)	.000	
	N	50	50

Note: **The correlation is statistically significant at the 0.050 level (2-tailed).

7. Discussion

The research findings indicate that there is an improvement in student motivation after learning, both in the control and experimental classes, although with varying degrees of improvement. This is also observed in the variable of student learning achievements. In classes implementing hybrid learning, students are motivated to learn with the support of e-learning (Aristika et al. 2021). Meanwhile, in the control classes, there is also an increase in learning motivation, which may be because multimedia and animation courses are inherently engaging and creative, regardless of the teaching method applied. This is supported by Kowitlawakul et al. (2017), who stated that multimedia can enhance student motivation. However, although both groups experienced increases in motivation and learning achievement, according to the independent sample t-test, the experimental class exhibited a substantial difference from the control class following hybrid learning.

This research successfully addresses the first research question, demonstrating a significant difference in motivation between students taught in a hybrid learning environment and those taught using conventional methods. Hardanti et al. (2023) further elaborate that the effectiveness of learning significantly improved with the implementation of hybrid learning models, resulting in increased student motivation. Additionally, Bai et al. (2020) suggest that hybrid learning positively impacts motivation by enhancing students' belief in their academic abilities and reducing anxiety about learning, as evidenced by the relationship between learning motivation and academic self-efficacy, as well as the negative correlation between learning anxiety and learning motivation. Another study also suggests that students exhibit a high level of motivation to learn (Kantisa and Sitthitikul 2020). Additionally, Osman and Hamzah (2020) demonstrate that students display greater interest and motivation when engaged in hybrid learning environments.

The second research question is successfully answered by showing that students have better learning achievement when taught using hybrid learning. Hwang et al. (2019), Argyriou et al. (2022), and Rafiola et al. (2020) support this result by stating that students taught with hybrid learning showed greater improvement in learning achievement. Ikhsan et al. (2021) further clarify that blended learning has the most significant impact on self-efficacy, curiosity, attention, and satisfaction, respectively, contributing to the enhancement of students' motivation and subsequent academic achievement. Furthermore, Budhyani et al. (2022) discovered that blended learning incorporating both synchronized and unsynchronized settings positively influences students' self-efficacy and learning outcomes in basic design, thereby enhancing the joyfulness and effectiveness of the learning process.

Finally, this research successfully answers the third research question, showing a significant relationship between student motivation and learning achievement, indicating that the higher the motivation, the higher the learning achievement and vice versa. A study revealed a noteworthy link between intrinsic motivation and academic achievement (Silva, Castillo, and Borré 2018). Motivation is considered a contributing factor to academic performance among engineering students (Tayebi, Gomez, and Delgado 2021). However, Nurwendah and Suyanto (2019) found a weak correlation between self-efficacy and the academic success of high school students. This could be due to the differing levels of self-efficacy and academic achievement among high school students compared to undergraduate engineering students.

Vu et al. (2022) found evidence of how motivation shapes learning achievements through a reciprocal relationship. When students are motivated, they exhibit increased engagement, resilience in the face of obstacles, and a commitment to achieving excellence. This heightened motivation not only fosters a conducive learning environment but also directly influences academic performance. Theoretical frameworks, such as ability self-concept, task values, and achievement motives, shed light on the intricate interplay between motivation and achievement. Moreover, expectancy components, such as self-efficacy and self-concept, emerge as strong predictors of academic success, surpassing the influence of intelligence and prior performance. In essence, motivation serves as a catalyst for learning achievements, highlighting its significance in educational outcomes.

he study possesses several constraints that warrant acknowledgment. Primarily, the sample size is relatively modest, which could potentially restrict the applicability of the results to a broader population. Additionally, focusing solely on students from the specific department restricts the applicability of the results to broader student populations or different academic disciplines. Furthermore, reliance on self-reported questionnaires and exam scores for assessment introduces the possibility of bias or inaccuracies. Although validity and reliability testing were conducted on assessment instruments, there may still be limitations in capturing the complexity of motivation and learning achievement. The study may not have accounted for all potential confounding variables that could influence these outcomes, such as prior educational experiences or extracurricular activities. Moreover, the study primarily focused on short-term effects of hybrid learning in multimedia and animation courses, with limited assessment of other important outcomes or sustained impacts over time. Finally, the findings may lack external validity beyond the context of multimedia and animation courses within the informatics engineering department, limiting their broader applicability to different disciplines or educational settings.

8. Conclusion

This study has demonstrated the significant impact of hybrid learning on both motivation and learning achievement among students in multimedia and animation courses within the informatics engineering department. The findings suggest that hybrid learning methods effectively enhance student engagement and academic performance. The results of independent sample t-tests confirmed significant disparities in motivation and learning achievement between the control and experimental classes. Moreover, Pearson correlation analysis revealed a strong and substantial correlation between motivation and learning achievement, further emphasizing the importance of fostering motivation in educational settings. These findings underscore the potential of hybrid learning approaches to optimize teaching and learning outcomes in higher education contexts, particularly in fields like multimedia and animation.

For future studies, it is recommended to explore the effects of hybrid learning on student motivation and learning achievement beyond the immediate instructional period. Investigating the specific mechanisms through which hybrid learning enhances motivation and academic performance could deepen our understanding of its effectiveness. This could involve qualitative research techniques like interviews or focus group discussions to capture students'

experiences and perceptions. Furthermore, examining the role of instructor training and support in implementing hybrid learning approaches could provide valuable insights into best practices for optimizing its benefits. Lastly, exploring the generalizability of findings across different disciplines and educational contexts would contribute to the broader applicability of hybrid learning strategies in higher education.

References

1. Agatha Priska, Meilia, Dilla Aulia, Erlinda Muslim, and Lidya Marcelina. 2020. "Developing a Framework to Evaluate E-Learning System at Higher Education in Indonesia." ACM International Conference Proceeding Series 3:27–32. https://doi.org/10.1145/3439147.3439154.
2. Argyriou, Paraskevi, Kenza Benamar, and Milena Nikolajeva. 2022. "What to Blend? Exploring the Relationship Between Student Engagement and Academic Achievement via a Blended Learning Approach." Psychology Learning & Teaching 21 (2): 126–37. https://doi.org/10.1177/14757257221091512.
3. Aristika, Ayu, . Darhim, Dadang Juandi, and . Kusnandi. 2021. "The Effectiveness of Hybrid Learning in Improving of Teacher-Student Relationship in Terms of Learning Motivation." Emerging Science Journal 5 (4): 443–56. https://doi.org/10.28991/esj-2021-01288.
4. Bai, Xue, Xuan Wang, Jixin Wang, Jun Tian, and Qing Ding. 2020. "College Students' Autonomous Learning Behavior in Blended Learning: Learning Motivation, Self-Efficacy, and Learning Anxiety." In 2020 International Symposium on Educational Technology (ISET), 155–58. IEEE. https://doi.org/10.1109/ISET49818.2020.00042.
5. Budhyani, I Dewa Ayu Made, Made Candiasa, Made Sutajaya, and Putu Kerti Nitiasih. 2022. "The Effectiveness of Blended Learning with Combined Synchronized and Unsynchronized Settings on Self-Efficacy and Learning Achievement." International Journal of Evaluation and Research in Education (IJERE) 11 (1): 321. https://doi.org/10.11591/ijere.v11i1.22178.
6. Dakhi, Oskah, Dedi Irfan, Jalius Jama, Ambiyar Ambiyar, Wakhinuddin Simatupang, Sukardi Sukardi, and Maria Magdalena Zagoto. 2022. "Blended Learning and Its Implications for Learning Outcomes Computer and Basic Networks for Vocational High School Students in the Era of COVID-19 Pandemic." International Journal of Health Sciences 6 (June): 11177–86. https://doi.org/10.53730/ijhs.v6ns4.10976.
7. Damuri, Amat, Nasrulloh Isnain, Rahmatika Rahmatika, Abednego Priyatama, Yudi Irawan Chandra, and Arman Syah Putra. 2021. "E-Learning Proposal System in Public Secondary School Learning." International Journal of Educational Research & Social Sciences 2 (2): 270–75. https://doi.org/10.51601/ijersc.v2i2.72.
8. Dyrbye, Liselotte N., Matthew R. Thomas, and Tait D. Shanafelt. 2005. "Medical Student Distress: Causes, Consequences, and Proposed Solutions." Mayo Clinic Proceedings 80 (12): 1613–22. https://doi.org/10.4065/80.12.1613.
9. Edgar, Susan, Sandra E. Carr, Joanne Connaughton, and Antonio Celenza. 2019. "Student Motivation to Learn: Is Self-Belief the Key to Transition and First Year Performance in an Undergraduate Health Professions Program?" BMC Medical Education 19 (1): 111. https://doi.org/10.1186/s12909-019-1539-5.
10. Hardanti, N.C., D.M. Nabiila, and S.H. Wibawa. 2023. "The Study of Hybrid Learning towards English Student's Learning Motivation during the Pandemic Era." In Proceedings of the English National Seminar "Critical Thinking in English Education for a Just Society," 132–36.
11. Hwang, Ren-Hung, Hsin-Tung Lin, Jerry Chih-Yuan Sun, and Jang-Jiin Wu. 2019. "Improving Learning Achievement in Science Education for Elementary School Students via Blended

Learning." International Journal of Online Pedagogy and Course Design 9 (2): 44–62. https://doi.org/10.4018/IJOPCD.2019040104.

12. Ibáñez, María Blanca, Aldo Uriarte Portillo, Ramón Zatarain Cabada, and María Lucía Barrón. 2020. "Impact of Augmented Reality Technology on Academic Achievement and Motivation of Students from Public and Private Mexican Schools. A Case Study in a Middle-School Geometry Course." Computers & Education 145 (February):103734. https://doi.org/10.1016/j.compedu.2019.103734.
13. Ikhsan, J., N. Fitriyana, and Z. Arif. 2021. "Virtual Chemistry Laboratory in Blended Online Learning Mode: The Influence on Students' Motivation and Achievement." Pedagogika 144 (4): 158–79.
14. Indah Sari, Putri, Erni Erni, and Rumiri Aruan. 2023. "Students' Perception on Blended Learning in English Class during the COVID-19 Pandemic." Journal of English Development 3 (01): 14–23. https://doi.org/10.25217/jed.v3i01.2786.
15. Islam, Syaiful, Hasan Baharun, Chusnul Muali, Moh. Idil Ghufron, Mushfi el Iq Bali, Mualim Wijaya, and Ismail Marzuki. 2018. "To Boost Students' Motivation and Achievement through Blended Learning." Journal of Physics: Conference Series 1114 (November):012046. https://doi.org/10.1088/1742-6596/1114/1/012046.
16. Kantisa, Piyapan, and Pragasit Sitthitikul. 2020. "The Effects of Blended Learning on Thai University Students' Speaking Ability, Learning Motivation and Perceptions." The Journal of AsiaTEFL 17 (4): 1377–91. https://doi.org/10.18823/asiatefl.2020.17.4.14.1377.
17. Kowitlawakul, Yanika, Moon Fai Chan, Sharon Swee Lin Tan, Alan Swee Kit Soong, and Sally Wai Chi Chan. 2017. "Development of an E-Learning Research Module Using Multimedia Instruction Approach." CIN: Computers, Informatics, Nursing 35 (3): 158–68. https://doi.org/10.1097/CIN.0000000000000306.
18. Martin, Andrew J. 2001. "The Student Motivation Scale: A Tool for Measuring and Enhancing Motivation." Journal of Psychologists and Counsellors in Schools 11 (November):1–20. https://doi.org/10.1017/S1037291100004301.
19. Nurwendah, Wenty, and Slamet Suyanto. 2019. "Relationship among Self-Motivation, Self-Efficacy and Achievement of High School Student in Biology." Journal of Physics: Conference Series 1233 (1): 012009. https://doi.org/10.1088/1742-6596/1233/1/012009.
20. Osman, Norasyikin, and Mohd Isa Hamzah. 2020. "Impact of Implementing Blended Learning on Students' Interest and Motivation." Universal Journal of Educational Research 8 (4): 1483–90. https://doi.org/10.13189/ujer.2020.080442.
21. Putra, Dardya, and Endah Triastuti. 2019. "Application of E-Learning and Artificial Intelligence in Education Systems in Indonesia." International Journal of Computer Applications 177 (27): 16–22. https://doi.org/10.5120/ijca2019919739.
22. Rafiola, Ryan Hidayat, Punaji Setyosari, Carolina Ligya Radjah, and M. Ramli. 2020. "The Effect of Learning Motivation, Self-Efficacy, and Blended Learning on Students' Achievement in The Industrial Revolution 4.0." International Journal of Emerging Technologies in Learning (IJET) 15 (08): 71. https://doi.org/10.3991/ijet.v15i08.12525.
23. Severiens, Sabine, and Geert ten Dam. 2012. "Leaving College: A Gender Comparison in Male and Female-Dominated Programs." Research in Higher Education 53 (4): 453–70. https://doi.org/10.1007/s11162-011-9237-0.
24. Silva, W. F., F. C. Castillo, and D. F. Borré. 2018. "Academic Performance and Its Association with Class Attendance, Intrinsic Motivation and Gender in Engineering Students." Revista Científica Multidisciplinaria 3 (1): 10–16.
25. Suharsini, Arikunto. 2006. Prosedur Penelitian : Suatu Pendekatan Praktik. Jakarta: Rineka cipta.
26. Tayebi, Abdelhamid, Josefa Gomez, and Carlos Delgado. 2021. "Analysis on the Lack of Motivation and Dropout in Engineering Students in Spain." IEEE Access 9:66253–65.

https://doi.org/10.1109/ACCESS.2021.3076751.

27. Wong, Kung-Teck, Gwo-Jen Hwang, Pauline Swee Choo Goh, and Siti Khadijah Mohd Arrif. 2020. "Effects of Blended Learning Pedagogical Practices on Students' Motivation and Autonomy for the Teaching of Short Stories in Upper Secondary English." Interactive Learning Environments 28 (4): 512–25. https://doi.org/10.1080/10494820.2018.1542318.
28. Yustina, W. Syafii, and R. Vebrianto. 2020. "The Effects of Blended Learning and Project-Based Learning on Pre-Service Biology Teachers' Creative Thinking Skills through Online Learning in the COVID-19 Pandemic." Jurnal Pendidikan IPA Indonesia 9 (3): 408–20. https://doi.org/10.15294/jpii.v9i3.24706.