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Brief Research Report

From Being Amotivated to Motivated: Evidence of the Efficacy of Problem-Based Learning in Practical Skills Training

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Abstract: The investigation of the degree of amotivation and subsequent intervention towards the motivation of undergraduate vocational and technical education (VTE) students has not received the same amount of attention as other disciplines. Despite the negative impact of a lack of volitional drive on students' practical skills learning, there is scarcity of literature on amotivation among VTE undergraduate students. This study aimed to demonstrate the effectiveness of problem-based learning (PBL) in transitioning undergraduate students from a state of being amotivated to motivated. The study utilized a quasi-experimental research design and selected 168 students in their penultimate and final years majoring in agricultural education, business education, computer education, home economics, and industrial technical education who met the study's inclusion criteria. The intervention consisted of eight weeks of treatment and four weeks of follow-up meetings. An existing academic motivation scale was adapted for use, and data was collected through a self-report questionnaire. Data analysis was conducted using independent sample t-tests, and paired sample t-tests. The findings revealed that the level of amotivation among the students was high, and PBL had a significant impact on transitioning VTE students from being amotivated to motivated in the treatment group compared to those in the control group. Furthermore, the positive gains were maintained by the treatment group at follow-up. The study suggests that a PBL program can effectively address students' lack of volitional drive to engage in academic activities among undergraduate students majoring in agricultural education, business education, computer education, home economics, and industrial technical in Nigeria.

Keywords: Problem-based learning, motivation, amotivation, vocational and technical education.

1. Introduction

Globally, Vocational and Technical Education (VTE) has been leading the way in providing the necessary and demand-driven workforce for industrial development and social progress in any nation. VTE is at the forefront of training personnel in technical and vocational skills, preparing VTE graduates to secure employment, start their own businesses, and become self-employed in their respective fields of study (Federal Republic of Nigeria, 2013). Despite these objectives, empirical evidence in Nigeria has shown that VTE students lack the motivation to engage in practical skills activities, leading to low levels of participation in practical skills outcomes (Orji, 2015, 2021; Orji & Ogbuanya, 2018, 2022).

One significant factor associated with higher graduation rates and improved academic performance is student motivation. Studies have indicated that unmotivated students are more likely to have low class participation and engagement (Vallerand et al., 1997). Therefore, enhancing and sustaining students' motivation in practical skills activities is crucial. In this regard, a change in the learning environment could be beneficial. Problem-Based Learning (PBL), a student-centered teaching approach, aims to boost motivation. Specifically, PBL strives to cultivate students' intrinsic motivation (LaForce et al., 2017; Wijnen et al., 2018; Wijnia et al., 2011).

PBL is a learner-centered pedagogical model in which a real problem scenario or task is a stimulus for applying problem-solving, collaborative, and self-directed learning skills (Orji, 2021). PBL has been shown to be useful and effective in enhancing cognitive, affective, and behavioral skills in the classroom (Amin et al., 2020; Fidan & Tuncel, 2019; Orji, 2015, 2021). The PBL process propels students to approach complex and ill-structured problems from real-life contexts individually and encourages them to work cooperatively to engage in goal-directed behavior (Barrows & Tamblyn, 1980; LaForce et al., 2017). Previous studies have explored the application of PBL approaches to improve students' motivation. For example, Wijnen et al., (2018) investigated the relation between PBL and Dutch law students' motivation using a mixed-methods design. In this study, there was no differences was found for motivation between PBL and face to face students. In another study, Fukuzawa et al., (2017) found that PBL approach enhanced the motivation of Human Osteology students with more subject matter experience at the beginning of the course, however, decrease during the course. Additionally, Safitri et al., (2023) compared the motivation and learning outcome of 60 grade V students in Indonesia using Problem Based Learning (PBL) and traditional model and found that the motivation of students utilizing the PBL was higher than that of students.

Although these studies attempted to use Problem-Based Learning (PBL) to improve learning outcomes, performance, and motivation, we observed that firstly, these studies have had mixed results, especially in the ability of PBL to improve students' motivation. Secondly, the problem of inadequate sample size appears to be common in most of these studies. Additionally, these studies were not conducted with respect to practical skills learning that required a clear demonstration of active engagement as a result of motivational efficacy. Importantly, none of these studies carried out a baseline study to determine those with a serious lack of volitional drive to engage in any practical activity. This study aims to address these empirical gaps systematically in the current investigation.

We seek to fill this gap by examining the efficacy of the PBL approach on a group of amotivated Vocational and Technical Education (VTE) undergraduate students undergoing practical skills learning. Anchored on self-determination theory, which stresses that when the learning environment satisfies the three basic needs of autonomy, competence, and relatedness, students are more likely to become intrinsically motivated to learn (Katz et al., 2009). Motivation is crucial in the acquisition of practical skills, making it essential to investigate its effects on this particular student population. Overall, our study contributes to the increasing literature on PBL, practical skills, and motivation by addressing the following hypothesis: Is there a significant mean effect of PBL intervention in transitioning undergraduate students from a state of being amotivated to motivated? Is the outcome sustained after a follow-up meeting?

2. Methods and Materials

2.1 Design of the Study

The study adopted a non-equivalent control group pre-test post-test design. Thus, there was an intervention (treatment) group and a control group. Furthermore, the treatment and control groups were tested at baseline (pre-test), after intervention (post-test) and follow-up meetings. However, the intervention group received the practical skills training via PBL, while the control group received an alternative treatment (practical skills training via demonstration).

2.1.1. Ethics Statement

The research received ethical clearance from the Faculty of Vocational and Technical Education Research Ethics Committee, University of Nigeria. Participants' informed consent were obtained.

2.2 Participants and Procedure

A total of 168 VTE undergraduate students were accessed to take part in the study. One hundred sixty-eight (168) participants were randomized into 2 study groups having met the study inclusionary criteria. The inclusion criteria included having high level of amotivation, completing the informed consent in writing and being available to participate throughout the study period. The exclusion criteria were having high motivation at baseline as assessed by academic motivation scale (AMS), declining to participate even though there was evidence of high level of amotivation, and unwillingness to make oneself available throughout the study duration. These institutions have the necessary practical skills facilities to support Problem-Based Learning (PBL) through workshops in their teaching and assessment processes. Therefore, the selection of the study area is crucial, considering the pressing need to encourage students to actively participate in practical skills activities. Additionally, other important demographic characteristics such as gender and study hours were also taken into account to provide a comprehensive understanding of the students' baseline differences. The participants in the study were between the ages of 17 and 23 years old. More detailed information about the participants can be found in figures 1 and 2. See also Figure 3 for participant flow diagram.

The sample size was confirmed appropriate for the study using GPower 3.1 software (Faul et

al., 2007) based on effect size f = 0.25, alpha (α =.05), power (1– β = .95) and statistical test (F tests–ANOVA: Repeated measures, between factors). The approach for the selection of eligible participants was by summing up the participant motivation scores that enabled researchers to identify those with a low level of motivation. We used intact classes to assign the participants to the study groups: 84 participants were assigned to the treatment group and 84 participants were assigned to the no treatment group. The researchers administered the pretest (Time 1) 2 weeks before the intervention. Two of the researchers delivered the intervention using the PBL manual (Orji, 2015; Orji & Ogbuanya, 2018). The PBL intervention consists of 16 practical skills training sessions held for 8 weeks, and 4-week follow-up (held twice per week) conducted after a month. Each session lasted for 60 minutes. Participants in the treatment and control groups completed the AMS posttest (Time 2). Follow-up assessment (Time 3) was performed at the end of follow-up meeting for the study participants.

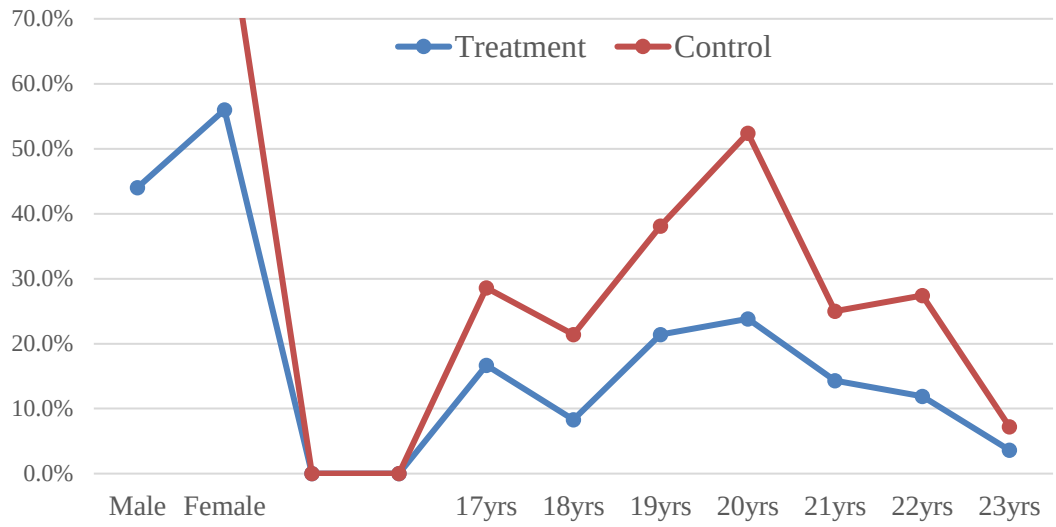

Figure 1. A chart showing the gender and age characteristics.

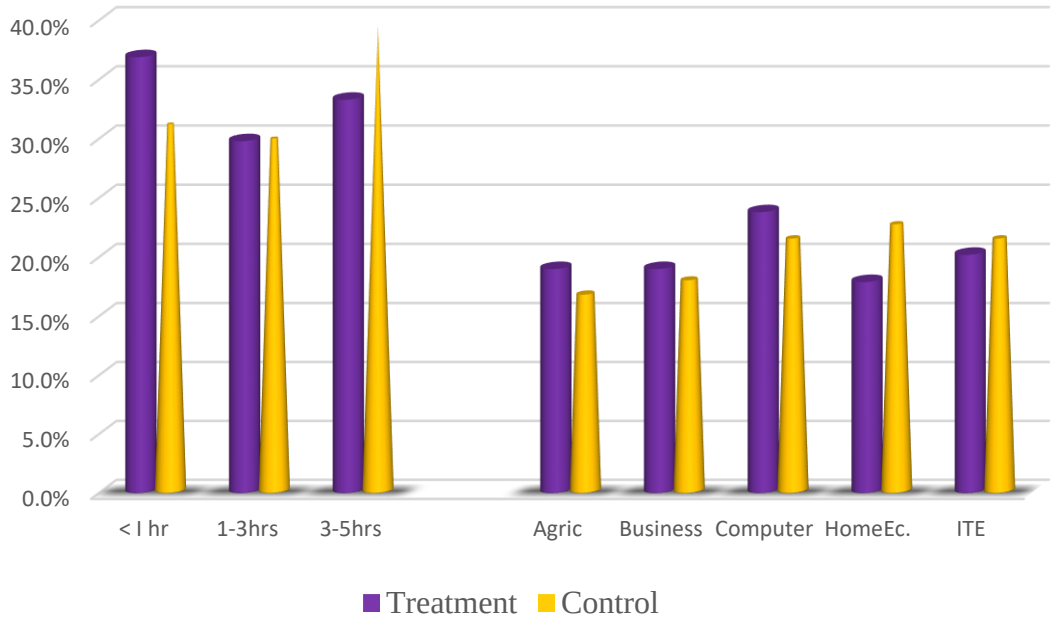

Figure 2. A chart showing the study hour and area of study characteristics of participants

2.3 Measures

No statistical approach was used to handle missing data in this study because there were no missing values. Additionally, confirmatory factor analysis (CFA) was conducted on all measurement scales using AMOS 24.0 to calculate the data fit indexes for each scale. The following criteria were used to assess the data fit: x2/df ≤ 0.3; CFI, IFI, and TLI ≥ 0.90; SRMR ≤ 0.08; RMSEA ≤ 0.06; PClose ≥ 0.05 (Kline, 2023)). The thresholds for composite reliability (CR) and McDonald's omega (ω) coefficients were set at ≥ 0.70 and ≥ 0.60, respectively. Discriminant validity (DV) was determined by comparing the square root of average variance extracted (AVE) with the correlation of latent variables in the CFA (Hayes & Coutts, 2020).

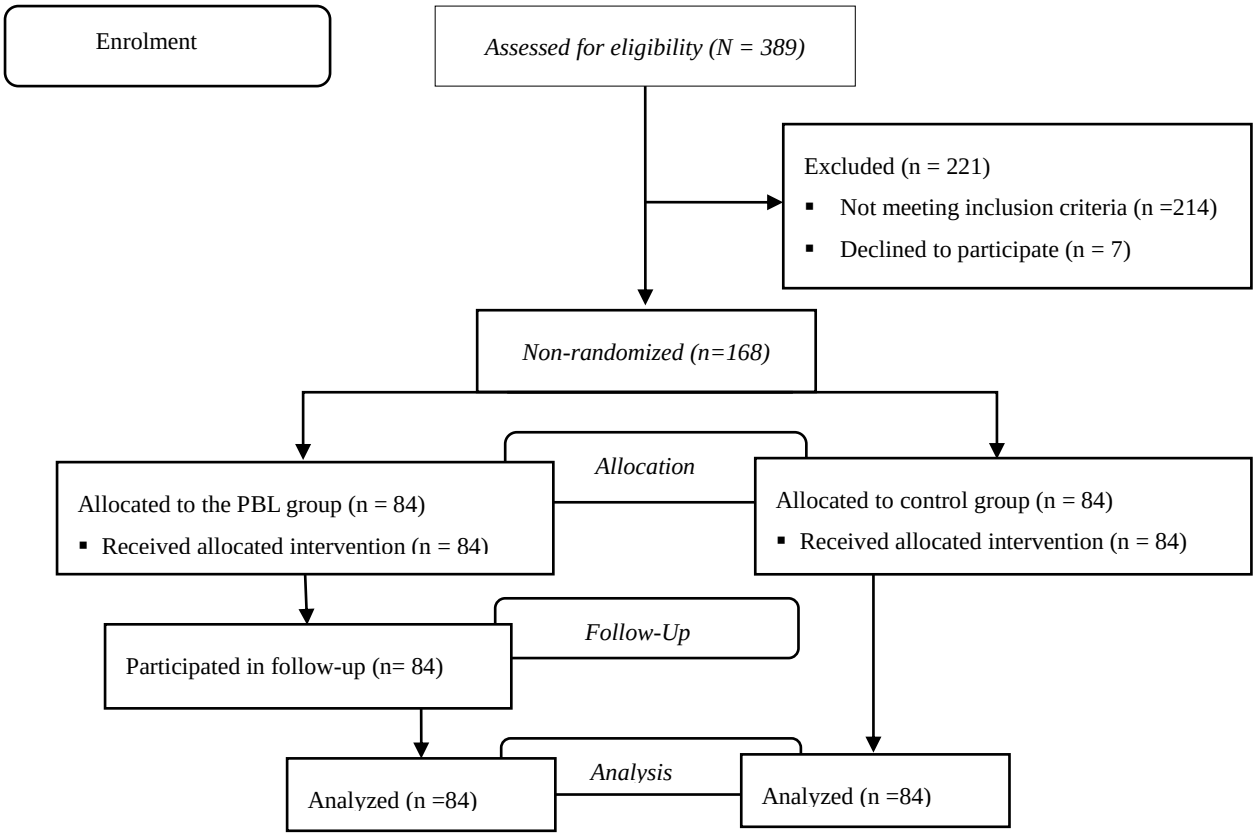

Figure 3. Participant eligibility criteria.

2.3.1 Academic Motivation Scale (AMS)

We used the four-item subscale adapted from the Academic Motivation Scale (AMS) by Vallerand et al., (1992) to measure VTE undergraduate students' state of being amotivation. An example item from the amotivation subscale is: "I once had good reasons for pursuing vocational and technical education; however, now I wonder whether I should continue with the practical's." The AMS was scored on a 5-point scale ranging from strongly disagree (0) to agree (4). In this study, we recoded the responses so that higher scores would indicate higher level of amotivation among the students. Previous research reported that the amotivation subscale of the AMS was reliable (Cronbach's alpha = 0.83) (Orsini et al., 2015). The same study also found that the amotivation subscale in the AMS demonstrated good discriminant, concurrent, and divergent validity (Orsini et al., 2015). The AMS total score ranges from 0 to 20, with higher scores indicating a high level of amotivation associated with practical skills learning. The cut-off score is set between 5 and 16. A respondent with a score of 0-5 is considered to be motivated, while a score of 10-16 is considered to still have a high degree of amotivation. Factor loadings for the items ranged from 0.584 to 0.768. The confirmatory factor analysis (CFA) showed good data fit: $\chi 2 = .670$; df = 2; $\chi 2/df = .335$; CFI = 1.00; TLI = 0.99; IFI = 0.99; SRMR = 0.010; RMSEA = 0.000; PClose = 0.80. The reliability coefficients are $\alpha = 0.859$ and $\omega = 0.860$.

2.4 Method of Data Analysis

The IBM Statistical Package for the Social Sciences (SPSS version 25) and Analysis of Moment Structures (AMOS version 24) was utilized for all data processing and analysis. Prior to

conducting the data analysis, data screening was performed. The data revealed no missing information, and all participants completed the pretest, posttest, and follow-up test. Additionally, tests for assumptions violations and data normality were conducted, showing that statistical assumptions were met and the data was normally distributed. Descriptive statistics were used to analyze the research data, employing independent sample t-tests. The paired-samples t-test was also utilized to assess if there were differences in assessment scores over time and between treatment and control group participants. Results were deemed significant at $P \leq .05$.

3. Results

Table 1. Results of students' mean amotivation level as measured by academic Motivation Scale.

Gender	*N*	*M±SD*	*Min*	*Max*	*95% CI*	
					LL	*UL*
Male	94	13.38±2.64	8.00	16.00	12.84	13.92
Female	74	13.24±2.89	8.00	16.00	12.57	13.91

N = number of participants; M = mean; SD = standard deviation; CI = confidence interval

The level of amotivation, as shown in Table 1 based on AMS subscales, indicates that male VTE students lack the volitional drive to engage in practical activities more (mean= 26.49; 95% CI=25.87,27.10) than their female counterparts (mean=25.79, 95% CI=25.10, 26.49). This demonstrates that individuals vary in their perceptions of what is important and motivating for achieving good work performance. Therefore, intrinsic and extrinsic rewards should be tailored to the specific needs and preferences of both male and female students.

Table 2. Between-group comparison for treatment and control groups at Time 1 and Time 2.

Measures	*Assessment*	*Group*	*N*	*M±SD*	*95% CI*		*p*
					LL	*UL*	
Amotivation	Pre-test	Treatment	84	13.35±2.88	12.72	13.97	.911
		Control	84	13.29±2.63	12.73	13.87	
	Post-test	Treatment	84	3.87.76±3.76	3.29	5.18	.000
		Control	84	11.55±3.24	10.84	12.25	

N = number of participants; M = mean; SD = standard deviation; CI = confidence interval

Table 2 displays the effectiveness of Problem-Based Learning (PBL) on reducing amotivation in Vocational and Technical Education (VTE) undergraduate students during practical skills training. The results show that there were no significant differences in amotivation scores between the treatment group (M = 13.35; SD = 2.88; CI = 12.72 – 13.97) and the control group (M = 13.29; SD = 2.63; CI = 12.73 – 13.87) at Time 1 (pre-test); t(1,166) = .112, p = .911. However, there was a significant main effect of treatment on amotivation at Time 2 (M = 4.24; SD = 4.33; CI = 3.29 – 5.18) compared to the control group (M = 11.55; SD = 3.24; CI = 10.84 – 12.25); t(1,166) = -12.391, p < .001. This improvement was maintained at follow-up (Time 3) (M = 18.78; SD = 11.34; CI = 16.87 – 20.71), suggesting that students experienced increased motivation during problem-based learning

to actively engage in purposeful learning such as practical skills activities. These findings support the hypothesis that PBL can reduce amotivation in VTE students.

Table 3. Pair Sample t-test across the times of Measurement (pretest, post-test and follow-up).

Measures	*Assessment*	*Group*	*N*	*M±SD*	*t*	*p*
Amotivation	Pair 1	Time 1 - Pretest	168	13.32±2.74	12.462	.000
		Time 2 - Post-test	168	7.71±5.20		
	Pair 2	Time 2 - Post-test	84	3.87±3.76	1.059	.293
		Time 3 - Follow-up	84	3.26±3.54		

N = number of participants; M = mean; SD = standard deviation; CI = confidence interval

The paired sample results in Table 3 showed significant changes in the mean amotivation score [t(167) = 12.462, p< .001] among vocational and technical education students in the treatment group at Time 1 compared to Time 2. However, no significant changes were observed in the mean amotivation score [t(83) = 1.059, p = .293] among vocational and technical education students at Time 2 compared to Time 3. Therefore, the hypothesis was accepted. This shows that problem-based learning significantly improved the motivation of vocational and technical education students after the intervention and was sustained at follow-up.

4. Discussion

This study aimed to determine the effectiveness of problem-based learning (PBL) in transitioning vocational and technical education undergraduate students from a state of being amotivated to being motivated. The findings revealed that the PBL approach transformed the amotivated VTE students into motivated individuals with a high volitional drive to engage in goal-directed activities. This result was also sustained after four weeks follow-up meetings. The results indicated that problem-based learning remains a student-centered innovative approach that consistently has a positive impact on students. These findings support the views of LaForce et al., (2017); Sangestani and Khatiban, (2013); Sungur and Tekkaya, (2006), who have demonstrated the positive effects of PBL on student motivation. Similarly, other research results show that the PBL model can enhance student learning activities, as explained by Ernawati (2020), who suggests that the PBL model is feasible for use in the teaching and learning process and should be implemented in schools to improve student learning activities. However, our study does not align with the results reported by (Galand et al., 2010; Loyens et al., 2009; Wijnia et al., 2011). While the studies that found positive outcomes implemented only short-term PBL interventions, the other studies (Galand et al. 2010; Loyens et al. 2009; Wijnia et al. 2011), as well as the current study, were conducted within existing PBL curricula.

5. Conclusion

This study revealed that problem-based learning (PBL) significantly and progressively improved the motivation of Vocational and Technical Education (VTE) students. It is important to

note that this impact was not seen with the alternative practical skills experience. These findings enhance our understanding of how active instructional strategies like PBL can enhance students' motivation to actively participate in practical skills training. This study contributes to the literature on PBL, motivation, and practical skills by not only confirming the effects of PBL experiences but also showing that a follow-up meeting can sustain these improvements.

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Conflict of Interest

The authors declare that there is no conflict of interest.

Authors' Contributions

OCT: Conceptualization, Methodology, Writing Original Draft, and final proofreading.

JP: Conceptualization, Supervision, Methodology, and final proofreading.

EO: Conceptualization, Supervision, Methodology, and final proofreading.

Data Availability Statement

The original contributions presented in the study are included in the article. Further inquiries can be directed to the corresponding author.

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