



Investigating The Relationship Between Interactive Learning Environments And Learning Motivation: The Mediating Role Of Higher Engagement And Peer Assessment As Moderation

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ABSTRACT

Understanding the complex aspects that affect student learning experiences and outcomes has always become increasingly important in the changing academic landscape. For example, the previous academic achievement is the peak of a person's educational path to the moment. It includes a student's past record of accomplishments, which reflects their academic prowess, commitment, and preparation for subsequent academic endeavors. By reviewing comprehensive literature and using quantitative research methods, this study analyzes data collected from 400 college students. Using structural equation modeling (SEM), data is tested. The basis of this study is the method of sampling the facility, taking a non-probability sampling. Indicating that students who actively participate in these environments tend to have more intrinsic drive to study, higher engagement was found to be a major mediator. The moderating impact of peer assessment also brought attention to how the presence of peer evaluations might strengthen the link between active learning environments and learning motivation, highlighting the significance of group learning activities. These findings emphasize the necessity of including interactive features in educational environments and have practical consequences for educators and curriculum designers. Institutions can improve learning motivation by encouraging greater involvement and carefully integrating peer assessment, thereby promoting more meaningful and effective learning experiences for students. This study adds to our knowledge of the complex interactions that take place during the educational process and sheds light on how to improve learning settings for better student results.

Keywords: Learning motivation, Prior academic performance, Interactive learning environment, Higher engagement, Peer assessment.

1. Introduction:

One of the most important factors in the motivation and learning of a student is the behavior of a teacher. It is more likely to be internally encouraged and people are more likely to be with this activity if it is presented in a way that is selected Promotes feeling and highlights the significant benefits of performing it. An setting like this is referred to as an autonomysupportive environment and can be created by significant others like instructors(Hein, 2012). These settings use technology, group projects, and practical experiences to create immersive learning environments that significantly disrupt the way that education has traditionally been practiced. Although their influence on information acquisition and skill development is generally established, learning motivation is a subject of study that is as intriguing. The relationship between motivation and education cannot be denied and both factors are important to humans. People need to be encouraged to be constantly interested and devoted to a work, career, or subject matter, or to try to achieve a goal(JSh & Go, n.d.). There are several variables that can affect a student's learning performance. The primary concerns of student learning that a group of academics looked into included things like family background, learning

environment, and governmental policies. The primary determinants of accomplishment, particularly if the student was highly driven by themselves, were the student's school environment and teacher-related characteristics. To learn them and understand how, where, and when to apply them, learners must watch and engage in the necessary cognitive processes. Learning styles proponents contend that tailoring classroom instruction to students' preferred learning styles enhances the educational process (Omar, Mohamad, & Paimin, 2015).

Another important factor in determining academic performance is the incentive to learn which serves as a stimulus for the student's dedication to learning. When a mobile application is created and centered on the needs of young people, it is seen to be useful in raising student achievement and promoting successful learning outcomes (Szymkowiak, Melović, Dabić, Jeganathan, & Kundi, 2021). In academic settings, it is now normal and even referred to as "the defining characteristic of our age" to refer to global mobility. This development puts the challenge of accommodating various groups of multicultural learners and preparing these students for international jobs on educational business programs. The emergence of interactive learning environments has transformed the educational landscape as education has embraced a paradigm shift towards more dynamic, participative, and technologically enhanced learning settings (Mikhaylov, 2014). For the purpose of examining learner intention and settings, previous studies carried out in various task situations have identified a variety of elements affecting learners' attitudes towards learning. Researchers and teachers are increasingly interested in how to develop in a learning environment, as well as manage their behavior in student online learning settings. Self-regulating learners are defined as dedicated participants who successfully manage their learning activities in different ways such as planning and practicing learning materials, keeping an eye on their learning process, and having high self-confidence and motivational beliefs about the importance of learning (Liaw & Huang, 2013). An essential component of education is assessment. Peer evaluation has been utilized regularly in the context of assessment for learning to enhance students' academic writing. Students do not always participate as seriously in the peer assessment process as teachers and researchers want or expect. Despite the fact that peers assessment has a good impact on regular learning. As a result, when students do not take the assessment of peers seriously, their quality and efficacy are affected. Because both the assessor and the assess are working on complex tasks during the feedback process, research has shown that interaction is advantageous for learning (Shui Ng & Yu, 2021).

The Post Research section contains literature review, procedures, results, discussion, recommendations and results. Literature Review will critically analyze existing research on the relationship between learning incentives, previous academic performance, interactive learning environments, high engagement and peer evaluation. The procedure section will outline research design, data collection methods, and data analysis techniques. The result will present the results of the data analysis, followed by a comprehensive discussion on the implications. Based on the results of the study, recommendations will be made for educators, curriculum designers, and policymakers. Finally, the study will conclude by summarizing the key outcomes and importance of promoting an educational environment that is the effectiveness of students, creatures and promotes sustainable performance.

2. Literature Review:

The purpose of this literary review is to explore existing research on the relationship between learning motivation, prior academic performance, interactive learning environment, higher engagement and peer assessment. Reviewing the current body of knowledge, this review seeks to provide a basis for identifying gaps in research and understanding the complex nexus between these elements in the context of education.

2.1 Learning Motivation:

Every aspect of life and stages of activity depend on stimulation. The stimulus we have affects our achievement and success in life. All human achievements are in one way or another in their center. Because all learning involves encouraging learning, motivation sometimes is called "the heart of learning", "the golden path of learning" and "a powerful element in learning". Proper motivation encourages student reflection, attention, interest and effort, which increases learning. It is always at the heart of all human endeavors in some way (Borah, 2021). Implementing the learning process in the classroom requires consideration of the existence of learning motivation, namely the incentive present in the educational environment. Strongly motivated students have a lot of enthusiasm for educational tasks. Motivation is related to how a person does an activity or task; the more intense and focused the motivation, the more successfully the learner completes the learning activity. Students are motivated when they are moved to engage in learning activities or desire to do so in order for such activities to become habits and a necessity for achieving goals. The main driving factor behind students' participation in teaching and learning activities is motivation. It keeps students engaged, maintains continuity, and gives learning activities direction so that they are expected to meet the students' learning objectives (Wardani et al., 2020). The researchers reviewed the impact of the assessment on students' self-confidence, internal stimulation, and concepts of success or failure. He discovered evidence that the importance of a stimulus component in classroom assessment, the non-majority of external motivation and

the importance of internal stimulation and self-organized learning for ongoing education inside and outside the classroom. In addition, Crooks drew attention to research, which is likely to create "back" rather than "deep" problems with external motivation (Harlen & Deakin Crick, 2003).

2.2 Prior Academic Performance:

Traditional academic success prediction models emphasize the significance of elements like intelligence and motivation. According to research, a student's learning orientation has a direct impact on their learning outcomes. Prior educational experiences are likely to have an impact on a person's orientation towards learning. Their learning style and how they view the demands of the assignment will both influence how they approach learning. Perceptions of learning tasks are also influenced by the learning context (curriculum, teaching strategies, and evaluation techniques) (Duff, Boyle, Dunleavy, & Ferguson, 2004). Even though middle school grading guidelines might vary, middle school grades are a good indicator of high school grades. The results of standardized achievement tests have also historically been utilized as reliable indicators of high school persistence and performance in the classroom. A variety of constructs, such as self-efficacy, motivation, locus of control, attitude towards learning, attention and persistence, as well as strategy and flexibility, have been highlighted in a number of single-sample studies that looked at the direct and indirect effects of PSFs and behavioral factors on academic success (Casillas et al., 2012). The conventional "chalk and talk" lecture model in college classrooms is starting to be challenged by learner-centered or active learning methodology. Collaborative, cooperative, problem-based, and cooperative learning are just a few examples of active learning in the classroom that have been found to produce better results than typical lecture pedagogy. Their grades, test results, and general performance in courses or educational programs they have finished before their current academic level are often included. Previous academic success is frequently utilized as a gauge of a student's aptitude and readiness for forthcoming educational challenges. It may have an impact on selections for programs, scholarships, admissions, and even employment chances. A student's skills, limitations, and likelihood of success in their current or future scholastic endeavors can be determined using this past data (Dong, 2019).

2.3 Interactive Learning Environment:

Implementing the learning process in the classroom requires consideration of the existence of learning motivation, namely the incentive present in the educational environment. Strongly motivated students have a lot of enthusiasm for educational tasks. Motivation is related to how a person does an activity or task; the more intense and focused the motivation, the more successfully the learner completes the learning activity. Teachers must work to encourage and inspire pupils to learn how to effectively complete learning activities. High-motivation and enjoyable teaching and learning interactions between teachers and students are anticipated to result in effective learning (Wardani et al., 2020). Although teachers should encourage their pupils to participate in learning activities and put out effort, we must be careful not to stifle their creative powers, extinguish their passion, or otherwise lose their interest in the subject. We must be careful not to hinder or obstruct our kids' participation. An interactive multimodal learning environment is where the learner's actions determine what happens. In short, the reaction to the learning process during learning is something that distinguishes interactivity. A multimedia message is provided in a pre-determined manner in an uninteractive multi-modal learning environment, regardless of what the student does when learning. An excerpt from the textbook with the stated animation or text and images is two examples of the non-interactive multi-modal learning environment. The words and images shown rely on the actions of the learner while learning in an interactive multi-modal environment (Moreno & Mayer, 2007). The continuum includes both entirely real and entirely virtual environments. Virtual and real items can coexist in immersive hybrid learning environments that are made possible by augmented reality. Students now have access to pre-accessible materials thanks to firefighting reality technologies that allow consumers to experience scientific phenomena that are unimaginable in the real world. There are no, like some learning processes (Khan, Johnston, & Ophoff, 2019).

2.4 Higher Engagement:

Higher educational institutions, their sub-schools and departments, as well as individual academics have long been interested in ensuring that once enrolled. Be a student and successfully complete your education as well as taking advantage of them as much as possible (Garrett, 2011). The ideas of student retention and student engagement encompass these two interrelated issues. The older of the two issues, at least in terms of study, is student retention, which was once also referred to by other, less positive titles like student withdrawal, attrition, and dropout. Although it is a more recent issue, student engagement or the degree to which a student is actively involved in their higher education represents a clear solution to the retention issue (Tight, 2020). Student participation as a notion struggles with a lack of definitional consensus and clarity, with its precise definition being both imprecise and the subject of debatable ongoing discussion. According to the definitions that are now accessible, engagement is a student-focused learning strategy that relates to student affiliation (learning and learning settings), Involvement (Emphasizes active shareholder in learning) and effort, energy and time (

trying criteria for learning). There is a clear and direct link between motivation and engagement, focusing on how motivation can support or facilitate engagement(Ferrer, Ringer, Saville, A Parris, & Kashi, 2022).

2.5 Peer Assessment:

Peer assessment is a process by which students evaluate and specify a level, value, or quality. Partner assessment activities can be changed in different ways depending on the curriculum area or the article in which they are used. The peer assessment can be used to review an output or a wide range of products, including writing, oral presentations, test performance, portfolio, and other special practices. The participant configuration can change: There may be pairs or groups of assessors and the assessed. Orientation can also differ: Peer evaluation may be unilateral or mutual. Even the goals of peer assessment might differ: The instructor may aim to achieve time savings, cognitive abilities or cognitive gains, or other objectives(Topping, 2009). An essential component of education is assessment. Peer evaluation has been utilized regularly in the context of assessment for learning to enhance students' academic writing. Students don't always take part in the peer assessment process as seriously as instructors and researchers would like or expect them to, despite the fact that peer assessment has regularly been shown to have a good impact on learning. As a result, when students don't take peer assessment seriously, its quality and efficacy suffer. Because both the assessor and the assess are working on complex tasks during the feedback process, research has shown that interaction is advantageous for learning(Shui Ng & Yu, 2021). Colleagues' assessment comes in a number of forms but basically, it involves giving students an opinion about their ability to work. The practice of peer opinion may occasionally involve giving a grade, although it is well known that it is a process that faces challenges. Peer assessment calls for students to provide their peers feedback or grades (or both) on a piece of work or a performance in accordance with the standards of excellence for those things, which students might have helped to establish(Spiller, 2012). Modern education increasingly emphasizes self-directed and collaborative learning due to the rising complexity of the workplace and professional activities. Peer assessment matches these new objectives because self-directed learning and collaborative learning imply that students take an active role in creating their own learning experiences. Peer evaluation is a method whereby students evaluate or are evaluated by their peers, in general terms. There are numerous ways in which this happens in educational practice. Peer assessment can take many different forms, including grading a peer's research report, offering insightful criticism on a classmate's presentation, or rating a fellow trainee's performance on a professional task(van Zundert, Sluijsmans, & van Merriënboer, 2010).

2.6 Hypothesis development:

2.6.1 The Effect of prior academic performance and interactive learning environment on learning motivation:

It is complex how past academic success and the effects of interactive learning environments on learning motivation relate to one another. Strong academic backgrounds may enable students to enter interactive learning environments with greater self-assurance which may have a good impact on motivation. They can describe these situations as a possibility of succeeding in new endeavors. On the other hand(Li, Yu, Liu, Shieh, & Yang, 2014). We acknowledge the prevalence and theoretical significance of learning settings that enable opportunities for collaborative learning. When examining aid seeking, it makes sense to take into account the two varieties of interactive learning environment independently. Social factors, in particular, are likely to have a greater impact on aid seeking in collaborative learning contexts than they do in solo learning environments(Aleven, Stahl, Schworm, Fischer, & Wallace, 2003). Test takers are encouraged by a variety of factors, including the socio-cultural context in which a test or testing program embodies includes test taker assessment familiarity and test benefits or errors. These factors include examiner motives, success or failure expectations, and assessment awareness when results are compared in different areas, times or cultures as is often the case in national and international mass assessment. This diversity of test compliance and test stimulation poses a serious threat to the authenticity of the tests(Baumert & Demmrich, 2001).

2.6.2 The Effect of prior academic performance and interactive learning environment on higher engagement:

Higher engagement may be influenced by a combination of earlier academic success and engaging learning environments, although these impacts are interrelated. Although previous academic success may have set the stage by influencing students' initial engagement tendencies, interactive learning environments have the potential to boost and sustain higher engagement levels by providing interesting and participative learning experiences. To design a learning environment that encourages active inclusion and as a result, more effective learning outcomes teachers and institutions should have a full understanding of this dynamic.

Researchers and teachers have been increasingly focused on the idea of student involvement in the classroom over the past two decades, as numerous studies have shown that it has different Includes development and educational results(Lam et al., 2014). In regard to outcome-based education, faculty or school administrators develop a policy or set of principles that underpin the teaching and learning activities. However, it is important to analyze the frequent criticisms from stakeholders, such as graduate students who claim they lack

fundamental knowledge and find it challenging to apply what they have learned to solve engineering challenges. In order to properly develop students into multi-skilled professionals for a prosperous future, the entire curriculum should be revamped and planned. Currently, concentrating on students' perceptions of their experience with a learning program is the most practical strategy in educational evaluation. A learning environment must be created with input from the students. The likelihood of students enjoying their work and wanting to get more involved is higher. However, as a subjective activity that is only as valid as the observer's impression, this technology is invaluable. This essay is being created to assess the significance of learning outcomes from the viewpoints of the students involved in it (Aziz, Yusof, & Yatim, 2012).

2.6.3 Higher engagement as a mediator:

For educators and researchers, it is crucial to comprehend the mediating role that greater engagement plays. It explains why learning outcomes may vary among students with various levels of past academic achievement. In addition, it emphasizes how important it is to design learning settings and teaching methods that encourage active participation as to encourage learning to do so and success can help reduce the negative effects of changes in previous academic success. Concerns have been raised about student involvement in higher education in recent years. Student participation in its most practical sense refers to the partnership that students do in their education through their time, effort and resources. Although more attention to the population of different students deviates from the individual student agency But this method draws attention to the range of elements that may be important for the student's involvement in various settings (Kahn, 2014). With increasing evidence of its importance in success and learning, student engagement is an existing discussion in higher education that is being studied ideology is being made and more and more is being discussed. However, engagement is a broad "Meta Construct" that seeks to bring together a number of research streams that contribute to the student's performance description. It is complex and comprehensive. This essay, which focuses on higher education, outlines these four strategies and seeks to make the concept of involvement more understandable and distinct from its causes and effects. An extensive conceptual framework is suggested that recognizes the significance of the student and the institution in order to advance our understanding and enhance the value of future research (Kahu, 2013). It will be crucial to take into account how various learning environments behave in light of the traits we have mentioned. In this sense, we see room to explain why some practices, such those that have been labeled "high impact," are more successful than others at engaging students. Such knowledge might subsequently be used to build further procedures that enhance student involvement (Vercellotti, 2018).

2.6.4 Peer assessment as a moderator:

To feel knowledgeable and confident about peer assessment, students require practice. Other classroom activities, like note-exchange and discussion sessions, can also help students get ready for peer evaluation. The literature on higher education attests to the widespread interest in peer and self evaluation. The interest in self- and peer-assessment is influenced by evolving ideas about teaching and learning, in part. Modern methods place a strong highlighting on student responsibility, meta-cognitive skills, learner responsibility and a dialogical, collaborative model of teaching and learning (Spiller, 2012). A small number of factors that might be crucial in peer assessment are only briefly examined in each study. All of them use experimental or nearly experimental designs to do this. Some of these factors are brand-new and could be quite effective at explaining performance variation. This represents a significant improvement over earlier efforts, which included numerous experiments with poorly controlled variables. Teachers have the key to increasing the effects of digital learning on teaching. In other words, the encouragement of digital learning can offer a modern alternative to traditional classroom education. Changes to traditional teaching methods will be a challenge but these challenges can be overcome if teachers often share their teaching experiences with peers or experts or share and learn through online communities, to advance teaching techniques, improve classroom management and demonstrate your professionalism and self-development (Topping, 2010).

H1: There is a significant relationship between prior academic performance and learning motivation.

H2: There is a significant relationship between interactive learning environment and learning motivation.

H3: There is a significant relationship between prior academic performance and higher engagement.

H4: There is a significant relationship between interactive learning environment and higher engagement.

H5: There is a significant relationship between learning motivation and higher engagement. H6: Higher engagement mediates the relationship between prior academic performance and learning motivation.

H7: Higher engagement mediates the relationship between interactive learning environment and learning motivation.

H8: Peer assessment moderates the relationship between learning motivation and higher engagement.

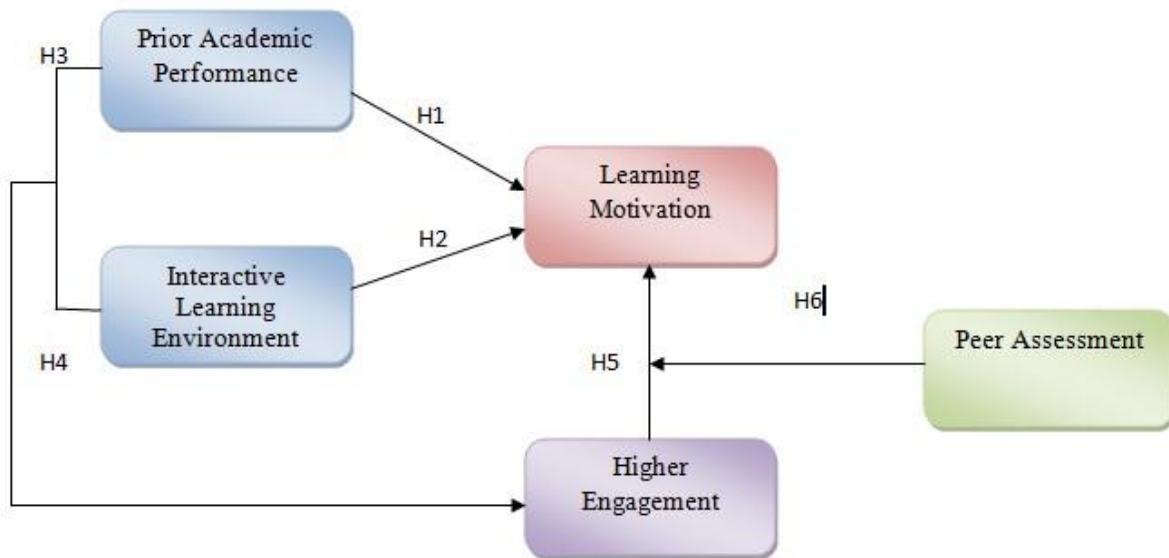


Figure 1: Conceptual framework

3. Methodology:

PLS-SEM with Smart PLS 3.0 is used to explore how demographics and problems may be affected. The next step involves analyzing scale accuracy to determine a measurement model's reliability and validity. We evaluate reliability using AVE, composite reliability, Cronbach's alpha, and validity using an HTMT ratio. The examination of a structural model is then done to look into a correlation among variables. The study uses a survey method to collect information from 400 students from Chinese university students. Data collection is done via a structured questionnaire. Out of 450 questionnaires, 400 were considered for statistical analysis because 50 questionnaires were not filled. The experimental tests of our working hypothesis were performed using a smart PLS.

3.1 Measures:

To collect information for the current study, a self-administered questionnaire was developed. The data collection tool was divided into two parts. The first was designed to collect demographic information about students (such as e.g. gender). The second part was dedicated to reviewing the constructions used in the study. The questionnaire included 25 items. A 5-point likert scale was used to collect data. The response type scale was used to reduce the respondents' "communication level" as well as increase the response rate and response quality (Babakus & Mangold, 1985). A 5-point likert scale that 'not strongly agree' with 'strongly agree' Work was done as it is most recommended by researchers that it reduce the level of frustration of the patient's respondents and respond Will increase the rate and response quality (Verma, 2004).

4. Data Analysis:

4.1 Demographic Analysis:

This section discussed the respondent's demographic characteristics. The demographics examined include gender, age and education. The table1 shows that 52% are male and 47% are female. The majority of the respondent, about 35% had 18-20 age, 28% had 20-24 and 15% had 24-28. 35% of students from computer science department, 20% students from accounting department, 15% students from english department, 20% from engineering department and 10% from law department for data collection.

Table1. Demographic profile of the respondents

		Frequency	Percentage
Gender	Male	208	52%
	Female	192	48%
Age	18-20	140	35%
	20-24	200	28%
	24-28	60	15%

	Computer Science	140	35%
	Accounting	80	20%
Education	English	60	15%
	Engineering	80	20%
	Law	40	10%

4.2 Measurement Scale:

Through the use of a structured questionnaire, data is gathered. The study items has been taken learning motivation (Wardani et al., 2020), prior academic performance (Casillas et al., 2012), interactive learning environment (Aleven et al., 2003), higher engagement (Garrett, 2011) and peer assessment (Topping, 2009).

4.3 Measurement model:

For estimation and analysis of reliability and validity, a measurement model is used (Jr, Hopkins, Georgia, & College, 2008). For measuring the internal consistency of variables, composite reliability is used and for measuring the reliability of elements, outer loading is used. A connection between variables is said to be normal when the reliability and validity of this construct have been established or met (Peter & Churchill, 1986). With the aid of Smart PLS 3.0, a measurement model's PLS-SEM analysis has been completed (Avotra, Chenyun, Yongmin, Lijuan, & Nawaz, 2021; Nawaz, Chen, & Su, 2023; Sandra Marcelline et al., 2022). Preliminary analysis, which saw the factor loading, accuracy and reliability of data collected from 400 university students, was done using PLS-SEM. Table 2 and Figure 2 list accuracy, reliability, and factor loading test results on items used to create PLS measurement models. As a general rule, the alpha value of Kronbach, which measures the internal consistency of an object, should be 0.70 or above (Xiaolong et al., 2021; Yingfei et al., 2021). Both alpha and CR values for cronbach's communication coefficient were more than 0.70 for selected variables. It established a contradictory mezzanine and proved that reliability was good because the values of the average variations (AVE) extracted for discrimination were more than 0.50 (Fornell& Larcker, 1981). Values of CR ranged from 0.810 to 0.855, all of that is higher than a value that was considered to be a threshold, which was 0.70. Our findings demonstrated that 0.6, 0.7, and 0.5 values for Cronbach's alpha, CR, and AVE for all of the aforementioned measures were acceptable (F. Hair Jr, Sarstedt, Hopkins, & G. Kuppelwieser, 2014).

Table 2. Reliability and Validity Analysis

Construct	Items	Outer loading	α	CR	AVE
Higher Engagement	HE1	0.599	0.810	0.869	0.573
	HE2	0.786			
	HE3	0.769			
	HE4	0.843			
	HE5	0.768			
Interactive Learning Environment	ILE1	0.571	0.764	0.843	0.520
	ILE2	0.690			
	ILE3	0.761			
	ILE4	0.785			
	ILE5	0.776			
Learning Motivation	LM1	0.814	0.755	0.838	0.526
	LM2	0.779			
	LM3	0.327			
	LM4	0.817			
	LM5	0.766			
Peer Assessment	PA1	0.749	0.857	0.89 8	0.637
	PA2	0.829			
	PA3	0.820			
	PA4	0.784			
	PA5	0.806			

Prior Academic Performance	PAP1	0.712	0.761	0.836	0.511
	PAP2	0.809			
	PAP3	0.770			
	PAP4	0.742			
	PAP5	0.502			

4.4 Discriminant Validity:

Comparing a correlation between a latent variable and AVE's square root provided discriminant validity with the general rule of thumb suggests using average variance retrieved with a score of 0.50 or more to assess discriminant validity. According to (Valaei, 2017) advises a square root of an AVE must be higher than the value of latent variables to demonstrate discriminant validity. A bootstrapping method provides confidence intervals, where the highest level of certainty should be less than 1. An absence of discriminant validity is demonstrated if an HTMT worth is 1, which denotes that a null hypothesis has been accepted (Sarstedt, Ringle, Smith, Reams, & Hair, 2014). After determining that the quality of reliability and accuracy of all variables has been met, we continued our investigation by analyzing the structural path. This was done when we concluded that structural path analysis was necessary. In addition, HTMT values were less than one, proving discrimination (Avotra et al., 2021).

Table 3. Discriminant Validity (Fornell-Larcker Criterion)

	Higher Engagement	Interactive Learning Environment	Learning Motivation	Peer Assessment	Prior Academic Performance
Higher Engagement	0.757				
Interactive Learning Environment	0.706	0.721			
Learning Motivation	0.543	0.471	0.725		
Peer Assessment	0.534	0.549	0.689	0.798	
Prior Academic Performance	0.628	0.613	0.677	0.638	0.715

Table 4. Discriminant Validity (Heterotrait-Monotrait Ratio)

	Higher Engagement	Interactive Learning Environment	Learning Motivation	Peer Assessment	Prior Academic Performance
Higher Engagement					
Interactive Learning Environment	0.896				
Learning Motivation	0.669	0.601			
Peer Assessment	0.637	0.682	0.861		
Prior Academic Performance	0.733	0.794	0.848	0.790	

This study used discriminant validity to ensure the external coherence of a model, comparing latent variables as given in Table 3 to determine discriminant validity (Fornell-Larcker Criterion). Thus, in summary, gives a variables' AVE as follows: Higher engagement (HE) 0.751, Interactive learning environment (ILE) 0.721, Learning motivation (LM) 0.725, Peer assessment (PA) 0.798 and Prior academic performance (PAP) 0.715. Table 4 demonstrates the discriminant validity (Heterotrait-Monotrait Ratio) thus, in summary, gives a variables' AVE as follows: Interactive learning environment (ILE) 0.896, Learning motivation (LM) 0.601, Peer assessment (PA) 0.861 and Prior academic performance (PAP) 0.790.

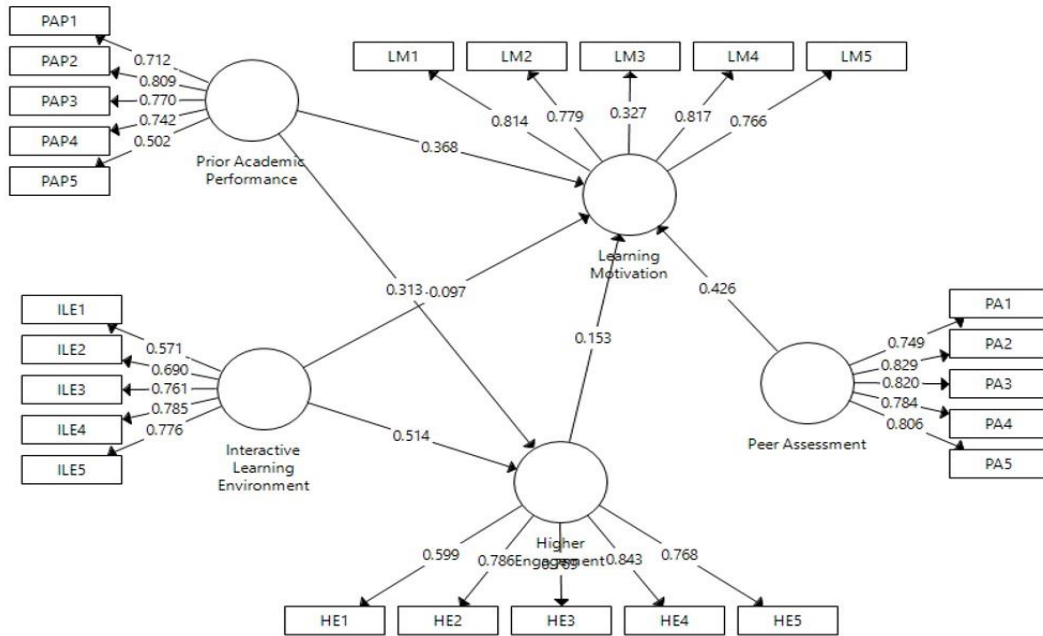


Figure 2. Measurement Model

4.5 Structural Equation Model:

Through the use of a PLS-SEM bootstrapping technique, structural model route coefficients that indicate a hypothesized correlation was found to be statistically significant. A PLS-SEM assessment of digital health technology has been empirically demonstrated to be a strong predictor of psychological well-being, as shown in Table 5 and Figure 3, which shows route correlations and testing decisions for the hypothesis. The conclusions reached by the researchers were presented in Table 6.

4.6 Quality Criteria:

R square is a “measure of the proportion of an endogenous construct’s variance that is explained by its predictor constructs” (Hair, Hult, Ringle, & Sarstedt, 2017). Values [0.25, 0.50, 0.75] Ranges [are used for small, medium, and large], respectively. The resulting values are caught in Figure 2. The Smart-PLS procedure in the PLS algorithm helps in the compilation of the data for small, medium, and large effect sizes, i.e. [0.02, 0.15, 0.35], specifically for the exogenous latent variable (Cohen, 1992).

Table 5. Hypothesis direct effect results

Hypothesis	Direct relationship	Std. Beta	Std. Error	P values	F2	R2
H1	Prior Academic Performance -> Learning Motivation	0.048	7.728	0.000	0.236	0.580
H2	Interactive Learning Environment -> Learning Motivation	0.052	7.844	0.000		
H3	Prior Academic Performance -> Higher Engagement	0.046	6.810	0.000		

H4	Interactive Learning Environment Higher Engagement	->	0.046	11.087	0.000		
H5	Higher Engagement Learning Motivation	->	0.058	2.633	0.009		

According to the findings, table 5 shows the results of the hypothesis. According to the findings, there is a statistically significant connection between prior academic performance and learning motivation ($t = 0.048, p = 0.000$). Therefore, Hypothesis 1 is permitted. According to the findings of a PLS-SEM analysis, there is a significant association between interactive learning environment and learning motivation ($t = 0.052, p = 0.000$). As a result, the study's second hypothesis was shown to be true statistically. Prior academic performance and higher engagement are statistically significantly related ($t = 0.046, p = 0.000$). Therefore, the third hypothesis is permitted. The significance of connections that exist between interactive learning environment and higher engagement ($t = 0.046, p = 0.000$) was a subject of a fourth hypothesis that was investigated in this research hence, a fourth hypothesis is supported. There is a statistically significant connection between the higher engagement and learning motivation ($t = 0.058, p = 0.009$). Therefore, the fifth hypothesis is permitted.

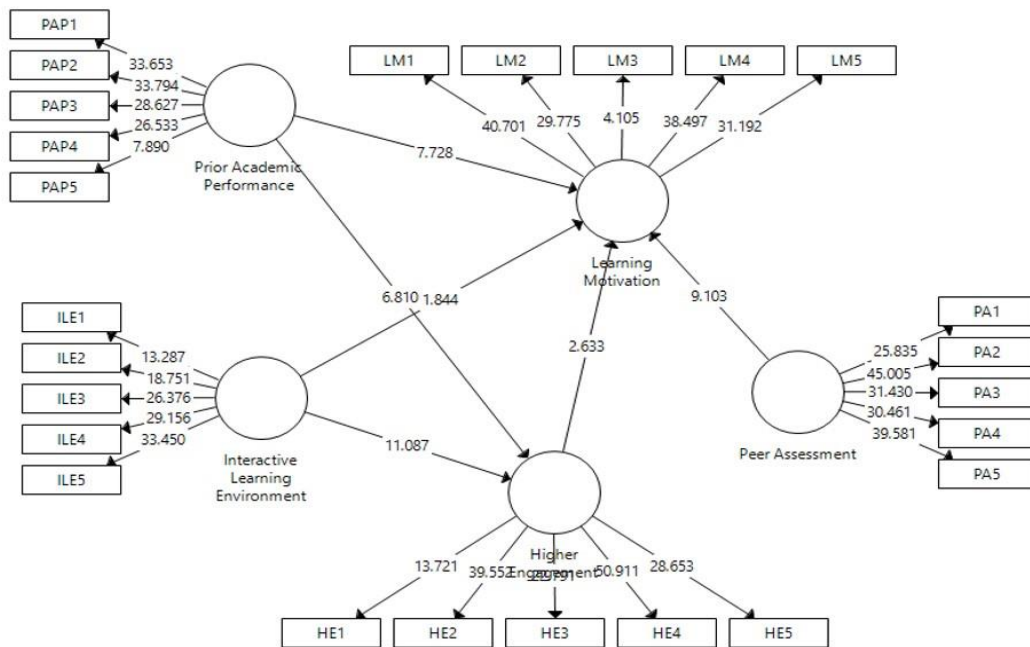


Figure 3. Structural model

4.7 Mediation Analysis:

The hypothesized indirect association among the variables is established in mediation analysis even when the learning engagement was included as a mediating factor in the connection among prior academic performance, interactive learning environment and learning motivation. The indirect impacts of prospective factors are examined via bootstrapping. One of the most extensive and successful methods for evaluating a mediation effect is bootstrapping, which is gaining more attention from scholars (Zhao, Lynch, & Chen, 2010).

Table 6. Mediation analysis

Hypothesis	Indirect relationship	Std. Beta	Std. Error	P Values
H6	Interactive Learning Environment -> Higher Engagement -> Learning Motivation	0.029	2.702	0.007
H7	Prior Academic Performance -> Higher Engagement -> Learning Motivation	0.021	2.244	0.025

As a result, a study's findings showed that mediating hypotheses H6 and H7 are accepted. A calculated value ($p = 0.007$, $p = 0.025$) (Hair et al., 2017).

4.8 Moderation analysis:

The next step was to look at how peer assessment influenced the direct path linkages within the central model. As stated, the moderators can be either qualitative or quantitative variables (Fiedler, 2015). An interaction effect is the most popular method for studying the moderating effect in structural models, while there are other approaches. In the structural route model, this also serves as a moderating impact with a new structural relationship (Fan et al., 2016). If a substantial change from zero (that is, the null hypothesis is not supported) as it reflects moderation (Fiedler, 2015). Table 6 demonstrates the result of the moderation analysis. Peer assessment moderates the relationship among higher engagement and learning motivation ($b = 0.034$, $p = 0.258$).

Table 7. Moderation analysis

Hypothesis	Indirect relationship	Std. Beta	Std. Error	P Values
H8	HE*PA -> Learning Motivation	0.034	1.131	0.258

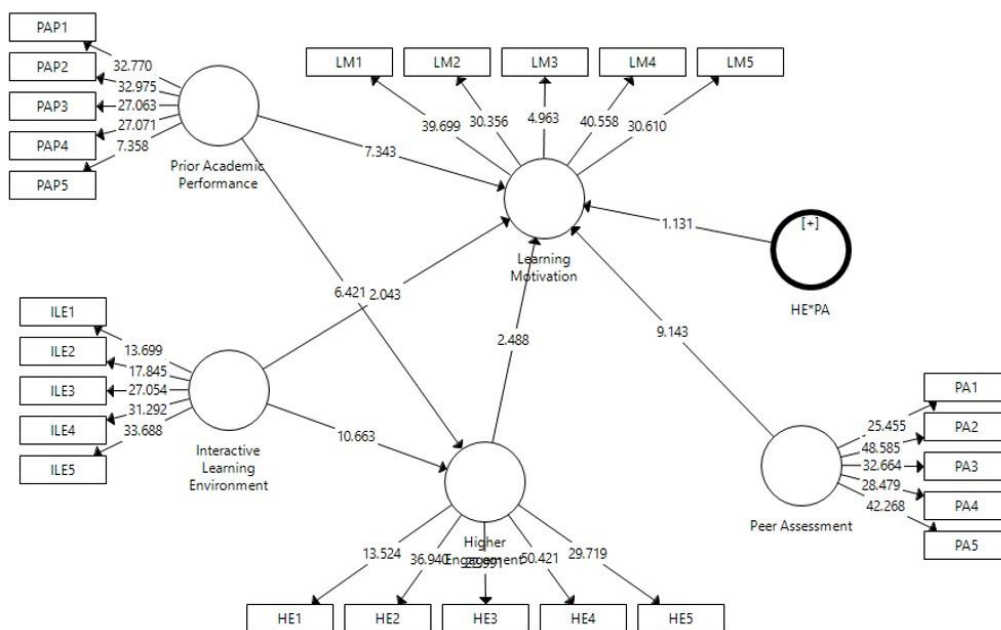


Figure 4: Peer assessment moderates the relationship among higher engagement and learning motivation.

Table 7. Variance influence factor

	Higher Engagement	Interactive Learning Environment	Learning Motivation	Peer Assessment	Prior Academic Performance
Higher Engagement			2.294		
Interactive Learning Environment	1.602		2.270		
Learning Motivation					
Peer Assessment			1.831		
Prior Academic Performance	1.602		2.189		

This research also checked VIF values (Table 6 View). All values are set below the limit, i.e. 5 degrees. The analysis discusses the relationship between variables from different methods and tools of data used to create statistical relationships. Tolerance and VIF, Composite Reliability and Accuracy, Discrimination (HTMT), Assumptions, Measurement Model, Structural Model, Mediation, R-square Assessment. And using smart PLS to diagnose effective sizes, multidimensional tests were included in all details. The next section will include limits, implications of application, results, and future strategies based on the discussion of these results.

5. Discussion:

The relationship between prior academic performance and learning motivation is dynamic. Interactive learning environments play a pivotal role in this relationship by offering engaging and enjoyable learning experiences. These environments stimulate intrinsic motivation by making learning relevant and by providing opportunities for autonomy and choice. They offer immediate feedback, reinforcing students' sense of control over their educational journey. Thus, while prior academic performance sets the stage, interactive learning environments have the potential to enhance learning motivation, rekindling enthusiasm for education, and bridging the gap between past performance and future motivation.

Interaction between previous academic performance, interactive learning environment, and learning motivation is complex. The interactive environment can strengthen the encouragement of academically successful students while also restoring motivation for those facing challenges. The positive effects of these environments are often mediated through high engagement. Engaged students show high level of motivation regardless of their previous performance. Therefore, it is important for teachers to understand this interaction. It guides the design of effective learning experiences that encourage students to take into account their diverse educational backgrounds. Interactive learning is capable of maintaining and enhancing the incentive to learn by providing an environment, interesting, pleasant and relevant learning experiences which creates a more dynamic and comprehensive educational landscape.

High engagement plays an important role by working as a mediator in educational research that helps to define complex relationships and mechanisms between different factors such as teaching interventions, prior academic performance, and learning outcomes. It clarifies the routes through which these variables interact and increase the predictive power of educational models. There are practical implications for the design of this understanding curriculum, the intervention strategy, and the appropriate approach to education which can enable teachers to create more effective learning experiences. However, the challenges include setting the groundwork for accurate measurement and mediation analysis. Overall, recognizing the role of high engagement mediation highlights its importance in shaping the educational landscape.

Peer assessment serves as a significant moderator in educational research, influencing the relationship between higher engagements and learning motivation. It reveals how external factors, such as peer evaluation, condition the dynamics between these essential components of learning. This moderation helps researchers understand when and under what conditions higher engagement positively impacts learning motivation. In practice, educators can strategically integrate peer assessment to enhance engagement, foster motivation, and provide valuable feedback. However, successful implementation requires careful measurement and consideration of the educational context. Overall, peer assessment's moderating role enriches our understanding of how engagement and motivation interact in the learning process, guiding educators in creating more effective learning environments.

6. Implications:

6.1 Theoretical Implications:

The theoretical implications of the study are important because they advance our understanding of how prior academic performance and interactive learning environment affect higher engagement in learning motivation. It contributes to the advancement of learning and motivation theories by providing empirical evidence of the intricate interplay between key educational variables. This research enriches existing theoretical frameworks, particularly those related to motivation, self-determination, and expectancy-value theories. Moreover, it has practical significance by emphasizing the importance of considering students' prior academic performance in pedagogical approaches, encouraging tailored strategies for diverse student backgrounds. Additionally, the study highlights the complexity of educational dynamics and the need for holistic models to understand these intricate relationships. Its findings have the potential to bridge insights across various academic disciplines, offering a comprehensive perspective on educational processes.

6.2 Practical Implications:

The study on the relationship between prior academic performance, interactive learning environments, and learning motivation, with the mediating role of higher engagement and peer assessment as moderation, provides several practical implications. It suggests tailoring educational interventions to account for students' diverse academic backgrounds, optimizing interactive learning tools, leveraging peer assessment as a

motivational tool, and promoting inclusive pedagogical approaches. Educational policies can be informed by these findings, and educators can benefit from professional development opportunities based on the study. Research-based decision-making, student counseling, and support services can also incorporate insights to enhance the overall educational experience, ultimately fostering improved learning outcomes for all students.

7. Limitations and Future Directions:

7.1 Limitations:

The study has several limitations that need consideration. Measuring constructs like engagement and motivation can be challenging, particularly with self-report measures. The complexity of multiple interrelated variables and the specific context of interactive learning environments and peer assessment introduce potential complexities in interpreting the results. Additionally, the findings may not directly apply to teachers, and there may be unexplored external factors at play. Despite these limitations, the study provides valuable insights into educational relationships, laying the groundwork for further research and practical applications.

7.2 Future Directions:

Future research in the realm of the study, “Investigating the Relationship between Prior Academic Performance, Interactive Learning Environments, and Learning Motivation: The Mediating Role of Higher Engagement, with Peer Assessment as Moderation,” holds promise in several areas. Longitudinal studies can offer insights into the evolving dynamics over time, while expanding research to diverse educational contexts and incorporating qualitative methods can enrich our understanding. Exploring teacher perspectives and their role in shaping student experiences, assessing the effectiveness of pedagogical strategies, and considering the influence of technology are important avenues. Additionally, examining cultural and socioeconomic factors, addressing teacher development needs, employing experimental designs, and evaluating the impact of interventions are all valuable directions for future investigation. By delving into these areas, research can provide a more comprehensive and nuanced understanding of the complex relationships among key educational variables, benefiting educational practice and policy.

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Appendix-A Questionnaire:

Investigating the Relationship between Interactive Learning Environments and Learning Motivation: The Mediating Role of Higher Engagement and peer assessment as moderation Dear Respondent, Greetings for the day. The present survey is purely for research purposes. All information given by you will be kept confidential and will be used for research. Your cooperation will be highly appreciated.

Respondent Name

Gender Male Female

Age 18-20 20-24 24-28

Education Computer Science Accounting English Engineering Law

Your feedback is very important for my research. Please read the following statement and mark accordingly: 1=Strongly Agree, 2= Agree, 3=Neutral, 4=Disagree, 5=strongly disagree.

Learning Motivation						
Learning motivation for both students and teachers refers to the desire, enthusiasm, or drive to engage in and excel at the process of learning and teaching, respectively.						
Q no.	Statement	1	2	3	4	5
1	Learning motivation in students is driven by factors such as personal interest, relevance, and the challenge of the material, which can lead to more effective and sustained learning.					

2	Extrinsic motivators like grades and rewards can influence students' performance, but intrinsic motivation, where they genuinely enjoy learning, often leads to deeper understanding.					
3	Teachers are motivated by their commitment to students' success and the desire to make a positive impact on their lives, fostering a love for learning.					
4	Continuous professional development and a commitment to enhancing teaching skills are common sources of motivation for educators.					
5	The rewards of witnessing students' growth and success provide teachers with a sense of fulfillment and motivation to continue their educational journey.					
Prior Academic Performance						
Prior academic performance refers to a student's historical record of achievement and success in previous educational endeavors.						
6	Teachers typically have a track record of successful academic performance, often holding advanced degrees and demonstrating strong subject knowledge, which forms the foundation of their teaching expertise.					
7	Students, on the other hand, are still in the process of building their academic performance records. Their prior academic performance, such as high school grades and standardized test scores, can influence their educational paths and future opportunities.					
8	While teachers draw upon their prior academic performance to educate and guide students, they also continue to engage in lifelong learning, pursuing professional development and advanced degrees to stay current in their fields.					
9	Students' prior academic performance can vary widely, reflecting differences in their individual learning journeys, interests, and dedication to their studies.					
10	Ultimately, both teachers and students can benefit from recognizing the importance of prior academic performance as a stepping stone to knowledge acquisition, skill development, and educational growth.					
Interactive Learning Environment						
An Interactive Learning Environment for teachers and students is a dynamic educational setting that promotes active engagement, collaboration, and the exchange of knowledge between educators and learners.						
11	In an Interactive Learning Environment for teachers, educators come together in workshops, seminars, and online communities to actively exchange teaching methods, collaborate on curriculum development, and share valuable classroom experiences.					
12	These environments empower teachers to stay updated with the latest educational trends and technologies, enabling them to provide more engaging and effective instruction to their students.					
13	For students, an Interactive Learning Environment is a classroom setting where traditional lectures are complemented by hands-on activities, group discussions, and technology-enhanced learning experiences.					
14	Students are encouraged to collaborate with peers, ask questions, and actively participate in the learning process,					

	fostering critical thinking, problem-solving, and a deeper understanding of the subject matter.					
15	Interactive Learning Environments aim to create dynamic and engaging educational experiences that promote active participation, knowledge exchange, and the development of 21st-century skills necessary for success in today's world.					
Higher Engagement						
Higher engagement of teachers and students refers to an increased level of active participation, interest, and involvement in the teaching and learning process. It implies that both educators and learners are more deeply committed and invested in their respective roles within an educational context.						
16	Higher engagement of teachers is characterized by their enthusiasm for teaching, innovative instructional methods, and a continuous commitment to improving their teaching practices.					
17	Engaged teachers create an inspiring classroom atmosphere where students feel motivated to actively participate, ask questions, and explore the subject matter with curiosity.					
18	Students with higher engagement exhibit a strong intrinsic motivation to learn, driven by a genuine interest in the material, rather than solely relying on external factors like grades or rewards.					
19	Engaged students are more likely to develop critical thinking skills, analyze information critically, and apply their knowledge to real-world scenarios, making the learning experience more meaningful.					
20	Collaboration is often a hallmark of higher engagement among both teachers and students, with educators facilitating group activities, and students working together effectively to enhance the overall educational experience.					
Peer Assessment						
Peer assessment in the context of teachers and students involves the evaluation and feedback provided by one's peers, whether its teachers assess other teachers or students assessing their fellow students.						
21	Peer assessment promotes active learning by encouraging students to critically evaluate their peers' work, fostering a deeper understanding of the subject matter.					
22	It enhances students' communication and interpersonal skills as they engage in constructive discussions and provide feedback to their peers.					
23	Peer assessment can be used across various educational settings, from traditional classrooms to online courses, to assess a wide range of assignments, projects, or presentations.					
24	It helps reduce the workload on educators by involving students in the evaluation process, allowing teachers to focus more on guiding and facilitating learning.					
25	When properly structured and guided, peer assessment can be a valuable tool for improving the quality of student work and promoting self-assessment and reflection.					