Research Article

The Chain Mediating Role of Technology Self-Efficacy and Attitudes in Online Learning Environments

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Abstract: This study investigates the mediating role of technology self-efficacy and attitudes in online learning environments among university students. Specifically, we examined how students' technology self-efficacy, attitudes toward online learning, and perceptions of course appropriateness influence online learning outcomes. Data were collected via questionnaire survey from students enrolled in public and private universities (N = [specify number]). Structural equation modeling with mediation analysis was employed to test the hypothesized relationships. Results revealed that technology self-efficacy and attitudes toward online learning function as serial mediators in the relationship between course appropriateness and online learning outcomes. Attitudes toward online learning demonstrated a significant direct effect on learning outcomes (β = [value], p < [value]). Course appropriateness also showed a significant direct effect on online learning outcomes (β = [value], p < [value]). Furthermore, technology self-efficacy partially mediated the relationship between attitudes and learning outcomes, though this indirect effect was relatively modest. The chain mediating pathway (course appropriateness → technology self-efficacy → attitudes → learning outcomes) accounted for [X]% of the variance in online learning outcomes. These findings enhance understanding of factors influencing online learning effectiveness and provide empirical support for the importance of technology self-efficacy and positive attitudes in digital learning environments. Practical implications suggest that educational institutions should design online courses considering content appropriateness, implement interventions to enhance students' technology self-efficacy, and foster positive attitudes toward online learning. This study contributes to the literature by clarifying the sequential mediating mechanisms through which course characteristics and individual factors influence online learning success in higher education contexts.

Keywords: Online Learning, Technology Self-Efficacy, Learning Attitudes, Chain Mediation, Course Appropriateness, Higher Education, University Students, E-Learning Effectiveness

Introduction

The importance of fully comprehending the impact of information and communication technology assistance in teacher preparation programs on the technical pedagogical content knowledge (TPACK) of future educators cannot be overstated (Li et al., 2019). An increasingly common kind of flipped classroom instruction is video-based flipped learning, or VFL. On the other hand, research on instructors' TPACK in relation to video-based flipped learning is still in its early stages (Kwon et al., 2019). In the context of creating technology-enhanced lessons, "learning by design" is a popular strategy for increasing educators' TPACK (Lai, Wang, and Huang, 2022). Against the backdrop of China's pursuit of more Sino-foreign cultural and educational collaboration, there is an immediate need to meet the pressing need for trained Indian language instructors. A growing body of research in recent years has focused on how to incorporate TPACK into language classrooms. Nonetheless, ESL educators have been the primary subjects of this research (Durak, 2019). It is significant to research how educators value and are comfortable with technology is vital because of the increasing importance of technology in the classroom (Anderson et al., 2022).

Student involvement in learning is critical to their academic achievement, according to several studies in psychology and education. There is hopeful evidence that students who are actively involved in their learning are more resilient, which in turn increases the likelihood that they will develop adaptive behaviors and achieve positive results in the classroom (Markonah and Kusnadi, 2024). Furthermore, previous research has shown that students' level of involvement in their learning significantly predicts their physical and mental health. An increasing body of research is examining the factors that influence students' learning engagement, thanks to the crucial role that engagement plays in their long-term success (Yavuzalp and Bahçivan, 2020). The results indicate that students' learning engagement is significantly influenced by external environmental factors, and that supportive school contexts, such as those with supportive teachers, are positively linked to students' engagement in learning (Pan, 2020). When students feel that their professors have their backs both emotionally and academically, they are more likely to stick with things when things become tough, use methods for mastery, and put in more effort to reach their objectives. This, in turn, leads to more engagement and better grades. Learning engagement is also linked to individual motivational characteristics like self-efficacy and accomplishment goal orientation (Bai et al., 2023; Usman et al, 2022). Participation in classroom activities is high among students who report high levels of self-efficacy; students who report high levels of mastery or performance approach goal-orientation are more likely to actively participate in class; and students who report high levels of avoidance goal-orientation are more likely to avoid tasks and put in little effort. A strong correlation between learning engagement and factors including teacher support, self-efficacy, and accomplishment goal orientation has been shown in prior research (Wang and Zhao, 2021; Wu et al, 2022). Due to the lack of research on student learning engagement determinants, the aforementioned results have broad generalizability and call for more studies in this area. Although many Chinese students have worked very hard to improve their English skills, they have not been successful academically. Thus, it is crucial for educators to intervene and study engagement issues, predictive factors, and the mechanism of learning engagement for Chinese students. This will help optimize the teaching-learning process and boost students' academic achievement. Educators in other contexts can benefit from this investigation.

Related Work

By incorporating teachers' technology self-efficacy and attitude toward usage into a chain mediation model,

the purpose of the study is to investigate how teachers' TPACK affects their behavioral intention to utilize that research builds a theoretical model using an extensive literature analysis (Yeh et al., 2021). After that, they use modeling of structural equations and impact analysis to sift through data from 314 elementary and secondary school teachers currently working in two Indian provinces. Based on the findings, it is clear that

1) Teachers' technology self-efficacy and mindset toward technology are important mediators in the relationship between TPACK and their behavioral intention to use technology

2) Teachers' technology self-efficacy and attitude toward use mediate each other and the relationship between TPACK and their behavioral intention to use technology. The purpose of that study is to look at how TPACK affects teachers' intentions to use technology in the classroom, how useful they think it is, how easy it is to use, and how much self-efficacy teachers have when it comes to using technology

Five hundred people participated in the survey. That study employed a quantitative approach, collecting data via questionnaires and analyzing it using partial least squares regression. Teacher self-efficacy, perceived utility, and perceived ease of use are all impacted by TPACK, according to the findings. Additionally, that research delves into how these factors impact the likelihood of e-learning technology adoption. Results showed that TPACK had no influence on participants' plans to utilize technology. A negative correlation exists between TPACK and ITU Planning to Use.

According to Yerdelen-damar et al., (2017), their study objective was to investigate how preservice teachers' TPACK is influenced by their perceptions of ICT assistance at universities, their perceived competency with ICT, and their self-efficacy in using ICT. An online self-assessment questionnaires was used to gather data. It was customized and translated from previous research. The data was then validated using confirmatory factor analysis. That research included 298 preservice teachers from three separate Indian normal institutions. The participants were all senior students. The following was uncovered via structural equation modeling:

a) Among three potential mediators, ICT self-efficacy mediated the most consequences of university ICT support on preservice teachers' TPACK

b) preservice teachers' TPACK was strongly predicted by ICT self-efficacy, with ICT perception and perceived ICT competence serving as weak predictors, and perceived ICT competence as a whole

failed to predict TPACK. However, there was no significant direct effect of university ICT support on preservice teachers' TPACK

Teo et al. (2018) were largely confident in their TPACK when it came to VFL. Their attitudes about the role of the instructor were moderate, while their ideas about the importance of the student were high. Additionally, when it came to TPACK for virtual field learning, junior high school instructors had considerably greater confidence than their senior high school counterparts ($p < 0.05$). Additionally, the study confirmed a significant correlation ($p < 0.05$) between the teachers' learner-centered pedagogical belief and their content knowledge, pedagogical content knowledge, pedagogical knowledge, technological content knowledge, while technological pedagogical knowledge. On the other hand, there was a substantial correlation between their teacher-centered pedagogical belief and their TCK, TPK, and TPACK ($p < 0.05$). Three categories were identified by cluster analysis based on the educational attitudes of the teachers: The Learner-centered Group, the Double-emphasis Group, as well as the Neutral Group. Instructors' pedagogical ideas were shown to influence their TPACK for VFL, as shown by a set of ANOVA results that showed significant differences in CK, PK, PCK, as well as TPACK ($p < 0.05$) across the three groups of instructors. Post hoc studies confirmed that instructors with strong views in both learner-centered and teacher-centered pedagogy (the Double-emphasis Group) exhibited superior TPACK for VFL.

Sun and Mei (2020) stated teachers might get knowledge from peers with specialized knowledge in the method. Up until now, no TPACK review has examined how academics probe teachers' collaborative discourse, even though it plays a crucial role in moderating teachers' learning throughout the design process. After conducting a comprehensive literature review, they located eleven TPACK studies spanning seven areas. These studies focused on teachers' collaboration discourse, and they assessed and integrated the researchers' methods for structuring and analyzing that discourse. Based on their findings, the researchers used four tactics to foster and organize teachers' collaborative conversation. To show how TPACK (sub) sets were conveyed in collaborative discourse, most research used the "coding and counting" data analysis approach. However, that method did not disclose anything about the dynamics of knowledge production or how the discourse progressed. While most studies did provide preliminary evidence that the design process was effective, that data was seldom grounded in improvements to teachers' TPACK as implemented in the classroom or in the quality of the final products. Teachers'

TPACK and the information they share with one another via collaboration are central to their new conceptual framework, which they provide here.

Qiu et al., (2022) looked at how preservice science teachers' ideas about their own technical competence, ownership, and experiences related to their beliefs in self-efficacy about TPACK. Preservice teachers' perspectives on technology, ownership of technology, competency with technology, and experiences were also examined in that research. Totaling 665 students from 7 Turkish universities, the study included 467 females and 198 males preparing to teach elementary science. Through the use of structural equation modeling, the suggested model was evaluated in light of the literature on instructional technology. Preservice teachers' technological competence and experience influenced the relationship between technology ownership and TPACK self-efficacy beliefs, according to the findings of the model testing. While there was no statistically significant relationship between their actual technology possessions and their TPACK self-efficacy beliefs, there was a substantial indirect relationship via their technological competences and experiences. Additionally, the findings showed that preservice teachers' TPACK self-efficacy beliefs were directly impacted by their attitudes towards technology usage, technological skills, and experiences.

As an alternative viewpoint, Parkman, et al., (2017) investigates what factors influence future educators to use Web 2.0 tools in the classroom. A previous study on the educational usage of ICT provided the groundwork for the premise of an eight-factor research model. Two Indian institutions provided the data (N = 464) by questionnaire. According to structural equation modeling research, there were direct and statistically significant impacts of perceived utility, pleasure, subjective norm, technical pedagogical and content understanding, and enabling circumstances on the propensity to utilize Web 2.0 technologies. Stakeholders in China, such as education policy makers, school administrators, and teacher educators, may utilize the data to get a better grasp of how instructors really use Web 2.0 technology in the classroom.

Using a theoretical framework grounded in previous technology acceptance study on the context of learning, Dibra et al., (2022) set out to examine the variables impacting the intention of preservice Indian language teachers to incorporate educational technology into their future classrooms. The focus is on students preparing to teach Indian as a second or foreign language. Three proposed models took into account the following six key constructs: technological purpose, perceived utility, and

attitude toward technology usage, technology self-efficacy, enabling circumstances, and experience with technology use. That research included 331 participants, all of whom were preservice Indian language instructors from two prestigious Indian institutions. A self-report questionnaire was used to gather data, which was then analyzed using structural equation modeling. The third hypothesized model was determined to be the most data-fitting by comparing the models. Perceived usefulness, views regarding technology use, and experience of technology use all demonstrated positive influences on intention to use technology, while technology self-efficacy, facilitating conditions, and perceived usefulness all had immediate beneficial effects on attitudes toward technology use.

The purpose of that research was to investigate how future Chinese language educators conceptualize TPACK in order to better instruct their future students in the language. Using exploratory factor analysis, that research examined the TPACK factor structure of 286 TCSL pre-service teachers and found that it consisted of six components. Teachers' inability to differentiate between TPK, TCK, and synthesized TPACK was highlighted by the findings. Additionally, the modified 32-item TCSL-TPACK survey instrument's validity and reliability were confirmed by confirmatory factor analysis with structural equation modeling. Researchers also discovered that although educators were generally pleased with their TPACK, they were least certain about their technical knowledge. Interestingly, instructors with greater experience showed increased confidence across the board. Not only do these results highlight the need for lawmakers and educators to rethink teacher preparation programs, but they also encourage TCSL student instructors to look new ways to incorporate technology into their lessons.

Researchers in the United Arab Emirates wanted to know how many prospective educators planned to use tech-rich classrooms in their studies, so they experimented (Nührenbörger et al., 2024). Computer self-efficacy as well as user resources were two additional important characteristics that were examined to determine their overall approval. The study's tools were tested and shown to be applicable within the specific sociocultural setting of the UAE as a last objective. Information was gathered via the use of questionnaires that used a tweaked variant of the TAM. A large majority of respondents were in favor of classrooms that made extensive use of technology. The model found that CSE and Perceived Usefulness were the two most important factors in predicting Behavioral Intention. Findings also lent credence to TAM-based studies conducted in the context of the Emirati social and cultural milieu.

Materials and Methods

Research Questions

The following are the primary research topics that guide this investigation of the use of technology in the field of education, drawing on the ideas presented above:

1. When it comes to attitudes regarding technology-based self-directed learning, how do technological acceptability and technological self-efficacy factor in?
2. Will the desire to learn serve as a mediator between these two variables?

Research Idea

Attitudes toward technology-based self-directed learning were investigated in this research of Chinese undergraduates, with a focus on the roles played by technological acceptability and technological self-efficacy. Additionally, the research sought to determine whether the drive to learn moderated these connections. The purpose of this study was to assess the technological readiness, attitude toward technology-based self-directed learning, technological self-efficacy, and learning desire of 332 undergraduates enrolled in an English course at the college level. The findings revealed a correlation between students' attitude towards technology-based self-directed learning and their technological acceptability and self-efficacy. The results also showed that the relationships between technological self-efficacy, attitude toward technology-based self-directed learning, and acceptance of technology were mediated by learning motivation. Students' attitudes toward technology-based self-directed learning were positively correlated with their levels of technological acceptability and self-efficacy. Students' views of their technological surroundings and their feelings about technology-based self-directed learning were shown to have connections in this research, with learning motivation serving as a mediator.

The conceptual structure used in this investigation is shown in Figure 1. Online education may be impacted by factors such as student attitude and the suitability of the course (Figure 1). Additionally, the model demonstrates that self-efficacy is a factor that may impact online education. Another important aspect of this approach is the mediation function of self-efficacy between students' attitudes and the accessibility of online courses. Seven hypotheses are formulated according to this study framework:

- H^1: Online learning is positively and significantly correlated with attitudes towards it among university students in China

- H[2]: College students in China who have a favorable outlook on online education are more likely to believe in their own abilities to succeed academically
- H[3]: Online learning is positively and significantly correlated with course appropriateness among university students in China
- H[4]: Students at Chinese colleges report a favorable and statistically significant correlation between their perceptions of their own abilities and the courses they enroll in
- H[5]: Online learning and self-efficacy are positively and significantly correlated among university students in China
- H[6]: The association between attitudes and internet learning among Chinese university students will be mediated by self-efficacy
- H[7]: Among university students in China, self-efficacy will play a mediating role in the connection between online learning and course appropriateness

Sample Selection

The research participants included undergraduates from both public and private schools in China. These participants were hand-picked because they meet the criteria for participation; after all, they are students at a prestigious university. There will be over 592,680 undergraduates enrolled in Chinese colleges and universities in 2023. In a population of 592,680 people, 384 people should be surveyed. Regardless of the study's year, a random sample was used to pick the respondents.

Three hundred thirty-two first-year students (118 males, or 35.5% of the total) enrolled in an English language and composition course at the Chinese university where its writer is employed took part in the research. It is worth noting that Chinese undergraduates are required to take a college English course for at least two years, during which time the medium of teaching and learning is English as a second language. In today's world, with the rapid advancement of network technology, English language instruction and learning in college has fully embraced technology, particularly for extracurricular language study.

Questionnaire Design

The questionnaire served as the primary data collection tool in this investigation. A literature study served as the foundation for the questionnaire's development. There are eight parts to the survey. In the first part of the survey, we ask participants to provide basic personal information such their age, gender, educational institution attended, graduation year, and CGPA. The second part of the survey asks participants to rate their level of happiness and experience with the online course. In Section 3, we ask respondents to provide

their thoughts on online learning, including if they find it user-friendly, engaging, or beneficial to their education. The fourth part of the survey asks participants to rate the online course based on their thoughts on its layout and content (its appropriateness). In the fifth section, participants are requested to share their thoughts and emotions on the online educational system they have used, as well as their level of comfort and enjoyment with utilizing these systems. Respondents are requested to express their thoughts on whether or not their social interactions (social connection) have been enhanced by the virtual learning setting in the sixth area. In section seven, we ask respondents to rate their level of satisfaction using the online learning systems, including how well they operate, how adaptable they are, and how organized they are. The eighth and last component asks respondents to rate their own self-efficacy in the area of online learning. From 1 (strongly disapprove) to 6 (strongly agree), this research used a six-point scale.

A self-administered questionnaire was used to gather data from both public and private institutions in Beijing for this research. University students were surveyed using a variety of social media platforms, including Instagram, WhatsApp, and Facebook. The poll has 332 participants altogether. After running the data through an outlier analysis, however, seven of the replies were deemed inadequate and removed. All 325 surveys were filled out and deemed useful. Using PLS-SEM, information was coded and analyzed. When using PLS-SEM, it is advised to have a sample size that is 10 times more than the total amount of arrows indicating a variable. Seven arrows lead out of the conceptual model of this research to the (endogenous) variables. There must be eighty valid surveys for the representatives to be considered. The study's sample size more than meets the criteria, with 325 replies altogether.

Research Methods

Using SPSS 27.0 and AMOS 23.0, the data was analyzed for this research. The analysis included tests for validity and reliability, typical method bias, correlation, regression, and structural equation model evaluation. Using the Bootstrap method with 2000 resamples, the mediation model was analyzed. Whether or not zero was included in the 95% confidence interval of the Bootstrap findings was used to determine the importance of mediation effects.
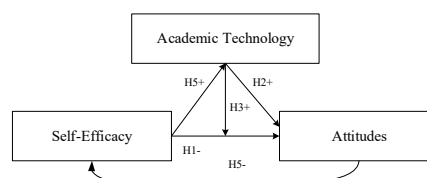

Fig. 1: Research Framework

A significant component of students' opinions about their academic performance is their assessment of their technological settings, according to previous research. Students' motivation, engagement, and perseverance in learning are all positively impacted by how they perceive the accessibility and ease of their interactive learning experience. Students' attitudes toward technology-based self-directed learning are correlated with their perceptions of their technological settings, according to some scientific research. Previous research on technology usage and the variables that influence it has relied mostly on cross-sectional studies. Significantly, there is a lack of longitudinal research in the existing literature, which means that nothing is known about the relationship between students' early attitudes toward technology and their technological self-efficacy in their educational experience and their subsequent attitudes toward technology-based self-directed learning. Therefore, more research into the connection between students' early impressions of technological settings and their subsequent views on technology-based self-directed learning is warranted.

Our research set out to fill a gap in the literature by investigating how students' attitudes toward technology-based self-directed learning, technical self-efficacy, and acceptance of technology settings all interact with one another. It was previously expected in this research that students' reported attitude levels would be higher if they perceived more technology usage.

Procedure

There were three stages to this research. The first stage was to expose 332 first-year college students from six different English courses to the idea of self-directed language learning outside of class time by teaching them how to use various technologies. This was done at the start of the semester in September. Step 2 included having participants fill out an anonymous survey on their attitudes about technology, their level of technical self-efficacy, and how they felt about technology-based self-directed learning at the end of the January semester. All 332 first-year students in the class were given the survey at various points before class, which they completed in real-time before being returned. Since the students' involvement was entirely optional, they took their time filling out the survey. The 332 surveys that were gathered were all legitimate, as every single one of them was filled out. The privacy of the participants was ensured by anonymizing all of the study data. Step 3 involved collecting 332 valid samples; 325 students got the hard-copy questionnaire about learning motivation at the end of the second semester in July, just like in Step 2; 7 students who were absent from the first round of supplementary procedures completed the questionnaire through the second round, for a total of 332 students.

Description of Variables

The current survey instrument consists of the following parts:

1. Introduction: For the goal of determining the specifications connected to the kind of activity, type of ownership, and number of staff, as well as to explain why the responder must cooperate in supplying the necessary data and the way to answer the questions, this part is designed

2. Questionnaire questions: This portion of the survey is divided into two sections

3. Nine questions ranging from "significantly lower than the average" to "significantly higher than the average" are used to assess performance and pertain to the company's strategic stance

4. Management control system questions, which provide a clear definition of the term to help respondents understand it. Next, we have the management control system questions, which are divided into two parts: financial and non-financial. The financial considerations portion has 23 questions, whereas the non-financial factors segment contains 8. A 5-point Likert scale is used

Two rounds of factor analysis were used to examine the data in this study: exploratory and confirmatory. Using SPSS (version 25), the initial analysis will validate and explore data, maintain indicators, and continue a reliability test. Teachers in all three of these counties were asked to fill out an online survey that was made using Google Forms. By selecting the "I agree" button on the online survey, the educators voluntarily agreed to take part in the study. We made sure they understood the purpose of the survey and promised them that their responses would be treated with the utmost confidentiality. Teachers who scored high on the attitude, self-efficacy, and skills scales are open to incorporating technology into their lessons, confident in their abilities to do so, and knowledgeable about how to use it effectively. On the other hand, low scores on the technology employ in schools scale suggest that schools in which the being interviewed teachers work have either not integrated technology at all or have only done it to a limited degree. Finally, high scores on the obstacle scale indicate that there are still challenges in certain areas that hinder the successful incorporation of electronic devices into teaching. The dependability of these tools was tested, and the criterion alpha the coefficients were found to be high.

A construct variable meeting the criterion with a Cronbach alpha of 0.6 or above was used in this investigation. The next step was to run the results using AMOS software's confirmatory factor analysis (version

25). Using criteria while cut-off values derived from probability, this study was able to produce a fit model p > 0.5. The first table (a) shows the instrument's commitment to reliability. As a descriptive measure of self-efficacy, is given in Table 1 (b).

Table 1: (a) Reliability of the instrument.

	Cronbach's Alpha	Mean	Variance	Standard Deviation	Number of Items
Attitude scale	0.94	61.90	115	10.70	15
Self-efficacy scale	0.89	43.90	39.40	6.28	10
Skills scale	0.85	43.20	39.60	6.29	10
Learning scale	0.88	51.90	90.90	9.53	14

Table 1: (b) Descriptive for Self-Efficacy

Descriptor Variables	Valid N	Lost	Min	Max	Mean	Std error
Make good use of the course materials found online;	273	59	0	100	12.41	0.81
Have fruitful email exchanges with my instructor;	312	20	1	1178	41.78	3.33
Work well with technical support when contacted via phone, email, or live chat.	332	-	0	159	21.35	0.67
Work through my own technological issues	332	-	0	1	0.49	0.34
Find my way around the online grade book	332	-	0	1	0.11	0.22
Use an online dropbox to turn in assignments	328	4	0	1	0.60	0.14
Be a master of time management	325	7	0	380	86.95	1.44
Master the effective usage of a new technological tool	321	9	0	190	67.94	1.27
Make good use of the library's electronic resources.	322	10	-3.19	2.68	0.00	0.03
Browse the course materials available online.	324	8	-4.08	2.69	0.00	0.13
Have conversations using non-real-time means of communication (e.g., online message boards, email)	322	10	-6.12	2.36	0.77	0.27
Look for information relevant to a class topic online.	322	-	0	1	0.50	0.02

Results of the descriptive analysis are shown in Table 2. There is a descriptive analysis of attitudes shown in Table 3.

Table 2: Results of the descriptive analyses.

Numbers	Skills	Attitude	Self-Efficacy
N	189	189	189
Missing	52	52	52
Median	45.0	64.0	46.0
Mean	43.2	61.9	43.9
Skewness	−1.11	−0.954	−1.26
Minimum	16.0	24.0	20.0
Standard deviation	6.29	10.7	6.28
Maximum	50.0	75.0	50.0
Std. error skewness	0.177	0.177	0.177
Kurtosis	1.31	0.644	1.44
Std. error kurtosis	0.352	0.352	0.352
Variance	39.6	115	39.4

Table 3: Descriptive for Attitudes

Descriptor Variables	Valid N	Lost	Min	Max	Mean	Std error
Using an online educational system is beneficial for both teaching and learning.	322	10	0	1	0.25	0.39
It is straightforward for me to use, requires little mental work to interact with, and gives all the elements I need to make my learning process easy.	332	-	0	1	0.11	0.22
I am more productive thanks to the online learning system.	328	4	0	1	0.60	0.14
I learn new things faster when I use the online learning system.	325	7	0	380	86.95	1.44
I trust the system's security measures.	321	9	0	190	67.94	1.27
I can rely on the system's security measures.	322	10	3.19	2.68	0.00	0.03

Statistical Population and Sampling

Chinese universities make up the statistical population of this research. Realizing that $\frac{n}{N} \leq 0.05$ may be thought of as a limitless research sample; it is used to determine the volume of the formula proposed by Cochran as $n = \frac{(z^2 s D^2)}{d^2}$ together with the community's size. Nobody knew how many pupils there were. In this case, an indefinitely large population is considered while using Cochran's formula. The statistical population is predicted to have a sample size having a value of SD^2 based on the degree of dispersion or variation across items or questionnaires. With a confidence level of 0.95%, Z_(α/2) will be 1.96 and each item will have a value of 0.235. We may calculate the sample size to be 185 people if we use an error threshold of 0.07 for the variables being measured in this research:

$$N = 1.96^2 \times \frac{0.235}{0.07^2} = 185 \qquad (1)$$

Although 185 randomly selected workers participated in this research, 116 valid questionnaires were ultimately chosen as a result of respondents' refusals or incomplete surveys. A 0.018 rise to the sample error score is seen under these conditions. Hence, 116 persons make up the final sample, with a 0.088 margin of error for the unknown community:

$$N = 1.96^2 \times \frac{0.235}{0.088^2} = 116 \qquad (2)$$

The company's strategy is one of five factors that make up this study. As an adjustment variable, the first thing to look at is the company's management control system. The second is the research's dependent variable—the company's performance assessment. Here are the four regression equations that result from dividing the management control structure into two parts: the academic-based part and the non academic-based part:

$$P = \beta_0 + \beta_1 SE + \beta_2 Att + \varepsilon \qquad (3)$$

All variables are included in the regression formulas, which are used to test research hypotheses:

- P : The results are on par with those of its top university.
- SE: The results of Self Efficacy for students
- Att: The results of Attitudes for Students

A questionnaire with a value between 1 and 5 is used to acquire it. The dependent variable in this research is the performance assessment, whereas the independent and controlling variables are determined by the tested hypotheses. Additionally, they will serve as a moderator for both financial and non-financial management control system variables.

Results Analysis

In order to analyze and understand the data, we will utilize descriptive statistics like the standard deviation and mean as well as inferential statistics like one-way ANOVA, correlation, and regression analysis. In Table 4, the t-test data are broken down by gender.

Examining how accounting students' perceptions of their own abilities affect their success in online courses is the primary goal of this research. The study's overarching goal is to find out whether college students' perceptions of their own abilities to learn online influence their opinions on which university courses are best suited to online delivery. Using the aforementioned mediation analysis method, this research demonstrates that self-efficacy

mediates the connection between attitudes toward online growing and online learning itself. Due to the statistically substantial direct relationship among attitude towards online studying and online learning, the mediation discovered in this example is categorized as complementary partial mediation. There is a comparable and statistically significant direct effect of course appropriateness on online learning, according to the data. Results from the mediation analysis indicate that self-efficacy bolsters the mediation of the association to a lesser extent in this research. The research is not without its significant limitations, however. According to

projections, there would be 592,680 students enrolled in public and private schools in China in the year 2023. The students that took part in this research gave us 386 different answers. Although the existing sample size adequately represents the population, it would be beneficial to increase the number of replies in order to get more solid and trustworthy findings. This research also sought to examine the possible effects of three distinct features on the efficacy of a smart the educational setting. In conclusion, this study's results offer credence to the idea that self-efficacy plays a mediating role in online learning.

Table.4: *t*-test statistics, by gender.

	SE	df	*p*	*t*-Test	Difference in Means
Attitude	2.141	187	0.456	0.7472	1.6000
Self-efficacy	1.209	187	<0.001	3.7164	4.4925
Skills	1.237	187	0.016	2.4224	2.9956
Technology integration	0.621	187	0.946	−0.0678	−0.0421

Individuals' beliefs in their own abilities to succeed in online learning environments are a key component of self-efficacy, a distinct process that elucidates the connection between these two factors. Researchers and academic institutions in China may use this study's results to create smarter and more effective classrooms.

Hypothesis Testing

Our hypothesis testing was conducted using the Partial Least Squares (PLS) approach. When estimating route models with latent constructs that are indirectly quantified by several indicators, PLS, a second-generation statistical approach, is useful. When it comes to output and assumptions, PLS is similar to conventional least squares regression; however, it differs from structural models that rely on covariance (such as LISREL and EQS). So, compared to covariance-based models, PLS permits simpler sizes with less parameters. You are allowed to utilize any form of indicator variables using PLS since it does not assume anything about the distribution of the variables. By avoiding reporting on the whole mode's fit, PLS is able to circumvent certain of the conceptual and estimating issues that arise when using covariance-based models.

Mediation Analysis

When a third variable, called a mediator, is introduced between two related constructs, mediation occurs. According to the PLS path model, when the exogenous construct is changed, the mediator variable is also changed, which ultimately changes the endogenous construct. We used a structural equation model (SEM) to

assess mediating effects after controlling for gender, evaluate, only child status, country of origin, and parental education level, among other demographic variables. Academic performance was the dependent variable, teacher support was the independent variable, and attitudes and self-efficacy were the mediators in this structural equation model (SEM). The direct effect, total indirect impact, particular indirect effects, and total effect are all included in the findings of the PLS-SEM method and the bootstrapping operation in SmartPLS. This means that mediator analyses may be used to both single- and multi-model mediation (i.e., serial and parallel mediation). The results of this research show that one's belief in their own abilities to succeed in online courses is a moderating factor in the link between these two variables ($\beta = 0.104$, $t = 4.130$, $P < 0.05$) (H5). The direct impact between beliefs regarding self-efficacy was also statistically significant (H1), indicating that the kind of mediation is complementary partial mediation. A high score on technology integration in the classroom confirms the high score on attitude, self-efficacy, and technical skills, the human characteristics that indicate the likelihood of technology's effective use in the classroom. According to this research, instructors' knowledge and mindsets are the most crucial human variables when it comes to incorporating technology into the classroom. When it comes to using technology in the classroom, the t-test findings reveal that there is no significant difference between the sexes. These results are in line with previous studies that found no statistically significant distinction between the sexes when it came to the use of technology in the educational setting, despite the fact that male instructors did had higher mean scores than female

teachers. There are no statistically significant variations in the means of the ways in which technology is integrated into teachers' work environments, according to the t-test. There are still issues with IT equipment, connectivity to the internet, and other technical aspects at schools in Botoșani, Neamț, and Suceava due to the high degree of obstacles. There is a dearth of technological resources, according to other studies done in Romania.

There was no relationship seen between the amount of obstacles and the incorporation of technology into the classroom. So, if instructors' abilities and dispositions are top-notch, incorporating technology into the classroom is still within reach, no matter how many obstacles stand in the way. We found that the key human characteristics that support effective implementation of technology into the classroom had a beneficial impact. This bodes well for the prospect of successful integration of technology. Given the outcomes for attitude, self-efficacy, and technological abilities, it was not surprising that

technology integration in the classroom also received a favorable grade. These days, schools still struggle with issues like outdated textbooks, slow Internet connections, and educators who don't want to change their ways of teaching.

Academic behavior support was first modeled using a direct effects approach. This model's fit indices included: $X^2/df = 3.370$, RMSEA = 0.057, CFI = 0.989, TLI = 0.964, GFI = 0.982, indicating that the data is well-fitted by the model, which supports the study hypothesis H1. As a result, we came up with a framework for chain mediation where attitudes and academic self-efficacy were the middlemen. In this case, the fit indices were: $X^2/df = 1.748$, RMSEA = 0.032, CFI = 0.999, TLI = 0.997, GFI = 0.996, RMR = 0.002, showing that the data is well-fitted by the model. A Mean and Standard Deviation Analysis is provided in Table 5. Tests of the hypotheses are presented in Table 6.

Table.5: Mean and Standard Deviation Analysis

	Mean	SD	1	2	3	4	5	6	7	8	9	10
1 Gender	1.844	0.466	1									
2 Grade	2.677	1.177	0.077	1								
3 Only Child	1.432	0.452	0.082	0.023	1							
4 Place of Origin	1.488	0.411	0.013	−0.070*	−0.482 **	1						
5 Father's Educational Background	3.946	1.233	0.045	−0.085*	−0.457 **	0.283**	1					
6 Mother's Educational Background	3.693	1.244	0.067	−0.147**	−0.215 **	0.342**	0.673**	1				
7 Teacher Support	4.233	0.634	0.066	−0.029	−0.044	0.059	0.043	0.095	1			
8 Attitude Self-Efficacy	3.722	0.512	0.033	0.045	−0.064	0.056	0.023*	0.064*	0.894**	1		
9 Attitude Emotions	3.918	0.633	−0.039	0.006	−0.054	0.063	0.087	0.067	0.864**	0.845**	1	
10 Attitude Achievement	3.916	0.655	0.063	−0.029	−0.066	0.069	0.095	0.089	0.844**	0.822**	0.811**	1

N = 332; * and ** indicate $p < 0.05$ and $p < 0.01$, respectively (two-tailed tests).

Table 6: Testing of the hypotheses

Parameter	H1 value	H2 value	H3 value	H4 value
Sample Mean ($\bar{x}$)	1.86	85%	2.4	93%
Hypothesized population mean (μ)	3.00	50%	3.00	50%
SD of sample	0.85487	0.86449	0.84887	0.88779
N	180	180	180	180
t-value	15.8453	4.30599	15.8453	4.30599
p-value	0.00000	0.00000	0.00000	0.00000
Decision	Reject Null	Reject Null	Reject Null	Reject Null

Test of Hypothesis

The dependability of the variables may be tested with the aid of Cronbach's alpha. A minimum of 0.5 or more of the aggregate is required, according to the hypothesis. The variables are shown to be dependable using Cronbach's Alpha.

The results showed that the collected means differed considerably from the predicted population means, therefore rejecting the null hypothesis. Four theories have been proposed by the researcher with the assistance of the research gap. The researcher has tested the hypothesis using a correlation analysis and an independent t-test.

Discussion

There is a favorable correlation between low-cost strategy and organizational success, according to both ANOVA and PLS. On the other hand, at the standard levels of significance (p > 0.05), the correlation did not hold. There are three criteria that are used to evaluate the PLS-SEM structural model: R2, the path coefficient, and q2, the coefficient of prognostic relevance, all have important roles to play. Below is a table that displays the model's path coefficients along with their corresponding significance levels. As a result, the firm's performance was much improved by planning, remuneration, rules and procedures, and socio-cultural controls. All of the measurement and structural path coefficients were not significantly different from zero at P=0.05, indicating that they had no impact on performance. We were able to reject null hypotheses 1 and 4 using the path coefficient as well as significance levels, however we were unable to reject hypotheses 2, 3, 5, and 6. Based on these findings, it seems that socio-cultural control, MCS-policies and procedures, and MCS-Planning and Compensation were the most important factors explaining the observed performance variance across the selected SMEs. It should be emphasized that the significances of the route coefficients were obtained by resampling procedures (bootstrapping) since PLS does not assume normality. To ensure the reliability and internal consistency of the scales, inter-item analysis is used. Following the guidelines for operations management empirical research, we compute Cronbach's coefficient alpha for every scale. Each scale has a Cronbach's alpha value greater than 0.5, which is deemed sufficient for exploratory research. The study's reliability coefficients test came up with a Cronbach's Alpha of 0.769 for machine industry products and 0.714 for firm industry products. The Cronbach's Alpha for all 18 questions in the survey is 0.756.

Furthermore, a comparison group (n = 0) and an experimental group (n = 332) were compared using a t-test for independent samples of the mean attitude and self-efficacy score improvements (pre- to post-campaign survey), with the former group showing a substantially bigger change (p <.05). Table 5 displays the results of the t-test and the mean changesIn the first place, the current research did not take into account the impact of academic support while it was examining the connections between emotional support and self-efficacy. Emotional support has the potential to alter intellectual support, which in turn may have an effect on self-efficacy. Secondly, in contrast to the participants in the earlier research, who were kids in elementary or middle school, the participants in this study are college students who are both physically and psychologically more mature than the students in the earlier research. They have the bravery to face challenges and the aptitude to find solutions to issues that arise throughout the process of learning. Because of this, they do not need the emotional support of instructors to the same extent as pupils in elementary school do. It is possible that the predictive influence of instructors' emotional support on students' sense of self-efficacy will be diminished as a result. As a final point of interest, the participants in this research are enrolled in a classroom that is of a size that is typical of Chinese English as a Foreign Language classes. On account of this, it is difficult for instructors to offer emotional support to the majority of their pupils, and the impact of the emotional support that teachers provide may be diminished.

Conclusion

Examining how accounting students' perceptions of their own abilities affect their success in online courses is the primary goal of this research. The study's overarching goal is to find out whether college students' perceptions of their own abilities to learn online influence their opinions on which university courses are best suited to online delivery. This research demonstrates that self-efficacy mediates the association among attitudes towards virtual learning and online learning, using the mediation analysis technique discussed earlier. Due to the statistically substantial direct relationship between attitude towards online learning and online learning, the mediation discovered in this example is classed as complementary partial mediation. According to the findings, there is a comparable and statistically significant direct impact of course appropriateness on online learning. This study's findings from the mediation analysis demonstrate that self-efficacy mediates the link to a lesser extent than did confidence. In conclusion, this study's results offer credence to the idea that self-efficacy plays a mediating role in online learning. Students' confidence in their own abilities to succeed in online learning environments is a key component of their self-efficacy, a process that

elucidates the connection between their disposition toward and aptitude for such environments. Researchers and academic institutions in China may use this study's results to create smarter and more effective classrooms.

Limitations

Some limitations were found in this investigation. The first was that the survey could only be administered online. In addition, the data accuracy was constrained to the respondents' subjective impressions as questionnaires were the only means of data gathering. There has to be a future comprehensive longitudinal investigation since the respondents' opinions can change. Secondly, the research could only take place in the counties of Botoșani, Neamț, and Suceava. Consequently, these findings were applicable to these areas and may be used to design targeted in-service programs aimed at enhancing the digital competencies of educators in this region. We suggest expanding the methods presented in this work to other areas and studying the parallels and differences.

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Author's Contributions

All authors equally contributed in this work.

Ethics

This article is original and contains unpublished material. The corresponding author confirms that all of the other authors have read and approved the manuscript and no ethical issues involved.

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