

Improving Teaching Quality in IT-Enhanced Learning: The Role of Student Engagement in Chinese Higher Education

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ABSTRACT: The rapid evolution of digital technologies has drastically changed the process of teaching and learning at universities all over the world. Chinese universities have adopted IT-enhanced teaching methods that help improve their effectiveness and reach. Yet, maintaining high levels of teaching quality within IT-enhanced learning is an emerging problem faced by higher education establishments.

The present study seeks to identify the factors influencing the quality of IT-enhanced teaching in Henan University of Technology in terms of teacher competency, student engagement, and resource allocation. The present paper employs a mixed-method approach in which the quantitative component is predominant. The surveys were administered to 180 students of the university in order to collect quantitative data, whereas semi-structured interviews were conducted with five teachers as well. The quantitative data analysis involved descriptive statistics, correlation, reliability, and multiple regression analysis using SPSS; the qualitative data was analyzed using an inductive approach.

The results suggest that both teacher competency, student engagement, and resource allocation have significant impacts on teaching effectiveness. Of the three variables, student engagement was found to be the most influential factor. In addition, based on the results from the qualitative portion of this research study, student engagement, instructional interaction, and institutional support are important factors in achieving effective digital learning.

This research provides valuable contributions to the literature on educational technology, as it gives an example from China in which the impact of student engagement on teaching effectiveness is emphasized. This paper can help universities find ways to improve teaching effectiveness via better engagement, increased teacher competency, and more efficient resource use within their institutions. The findings of this study also contribute to Sustainable Development Goal 4 (SDG 4), which emphasizes inclusive and quality education through effective digital learning practices in higher education.

Keywords: IT-enhanced learning, Teaching quality, Student engagement, Teacher competency, Resource allocation, Higher education.

1. INTRODUCTION

With the fast development of digital technologies, the process of learning and teaching at university level has undergone some changes on a global scale [1,2]. Many universities implement modern technology in the process of learning through various online resources, blended learning courses, and digital learning techniques that

improve the access and efficiency of instruction. As for China, the country has been experiencing a period of

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extensive development of IT through its policies and the use of online learning amid and after the pandemic of coronavirus [3]. Therefore, IT-enhanced learning is regarded as a key element of higher education reform and innovation.

While more technologies have been implemented in the field of education, there is still the issue of sustaining high levels of teaching quality when implementing IT-enhanced learning in higher education institutions [4]. The presence of technologies in the sphere of education may be insufficient to ensure high-quality learning because universities face some issues connected with participation in digital classes, instructional quality, adapting to digital technologies, and supporting their application. In many cases, digital learning leads to lower quality of instruction due to lack of motivation among students [5].

In particular, with regard to Chinese higher education, the quick shift towards the adoption of IT-enhanced learning has led to rising demands on educational establishments to combine innovation with ensuring quality of education. It is worth pointing out that many institutions invest substantial amounts of money in building advanced systems for digital learning, smart classrooms, and other IT-related facilities in the process of transforming their operations. At the same time, disparities in terms of technological advancement, teachers' abilities, and students' readiness to use innovative methods can affect the success of implementing IT-enhanced learning [6].

Thus, discovering what factors contribute to teaching quality in such circumstances can help promote improvements in learning outcomes. As far as relevant literature is concerned, there is a number of factors contributing to teaching quality in technology-based learning environments. In this regard, teacher competency can be highlighted as one of the most critical aspects as teachers need to be highly competent both pedagogically and technologically [7,8]. Additionally, resource allocation plays an important secondary role in IT-enhanced learning environment.

The issue of student engagement in recent times has proven to be one of the greatest factors affecting learning outcomes within the digital space of education [9]. Learning in a digitally supported manner entails that more self-regulation and active participation from the learners are expected than in a traditional physical classroom environment. Lack of engagement can render ineffective all efforts put into designing effective instructional designs, regardless of the availability of necessary IT resources [10]. Consequently, it becomes crucial to

consider how student engagement works within IT-enhanced learning environments.

While previous studies have shown how such aspects as teacher competency, institutional support, and student engagement affect learning outcomes, few studies have considered how the three variables can simultaneously impact teaching quality within Chinese universities. In addition, very little information is available on which among the factors mentioned above could play a major role in impacting teaching quality within such environments. In contrast to many past studies that tended to investigate these variables individually, the current study looks at their joint effects on IT-supported learning. Teacher competencies, student engagement, and resource use were chosen as the focus of this study, as they can be viewed as three key dimensions of IT-enhanced learning. They include the teacher, learner, and institutional perspectives respectively.

Thus, this study seeks to explore the factors that affect the quality of teaching within IT-enhanced learning environments in Henan University of Technology. In particular, the study focuses on the impacts of teacher competency, student engagement, and resource allocation on teaching quality using a primarily quantitative mixed-method research approach. Through determining the impacts of these factors, the study hopes to offer empirical insights on how teaching quality can be improved via effective IT-enhanced learning practices.

■ 2. LITERATURE REVIEW

■ 2.1. IT-Enhanced Learning in Higher Education

The integration of IT in higher education has been revolutionary as far as the learning process is concerned because it has revolutionized how education is provided all around the world [1,2]. IT-enhanced learning is defined as learning through the use of technological devices and software that aid the learning process [4]. In the recent past, a number of educational establishments have turned to using blended learning and digital learning approaches [5].

The increasing interest in information technology-supported learning can be attributed to the onset of the COVID-19 pandemic that made it imperative for universities to adopt alternative learning approaches such as online and blended learning [3]. However, some problems arose with regard to the use of these learning techniques [5].

While integrating technology in the classroom simply involves bringing technology into the learning process,

successful technology-enhanced learning requires proper integration between the pedagogy and technology [1]. Therefore, digital learning cannot succeed without integrating technology effectively in teaching to make learning interactive [2].

In the context of higher education in China, digital transformation has become a priority strategy for universities to achieve digitalization in their institutions. There has been extensive use of smart classrooms, online learning platforms, and technology. However, there remain some challenges when it comes to ensuring quality teaching and learning [11,12].

■ 2.2. Teacher Competency in IT-Enhanced Learning

The teacher competency factor was recognized as one of the factors influencing the quality of teaching in digital learning settings [6,13]. It is understood as pedagogical and technological competence, which allows incorporating digital technologies into the teaching process [7].

In view of modernization in education, shifting to online or hybrid learning models, the role of a teacher shifts from being a transmitter of knowledge to being a facilitator of learning. It requires teachers to be able to design interactive learning activities, manage digital classrooms, give feedback, and interact with students [5]. Therefore, the issue of professional development should be given particular attention by teachers [8].

In the TPACK framework, the focus is on the integration of technological, pedagogical, and content knowledge as the backbone for effective teaching in a digital world [7]. Those teachers that have a higher level of integration are more likely to produce high-quality lessons that are also engaging [13]. Inadequate levels of digital competency can hinder effective IT-enhanced learning practices [6].

Overall, competency of the teachers continues to be an essential enabler in educational settings with technology use.

■ 2.3. Student Engagement in IT-Enhanced Learning

Engagement among the learners has emerged as one of the key factors in gauging the efficacy of learning in digital learning environments [9]. In general terms, engagement is considered to be a multidimensional factor that consists of behavioral, emotional, and cognitive factors [9]. Behavioral engagement is related to learning activities, emotional engagement is related to

attitude, and cognitive engagement is concerned with the depth of learning activities.

In particular, student engagement is extremely important within IT-enhanced learning environments as learners have to regulate themselves in these environments for learning [10,14]. In contrast to classroom-based environments, learning through digital platforms requires self-regulation by learners [11].

As research proves, there is a positive correlation between the level of engagement in students and their academic success [5,10]. The reason is that engaged students tend to be more willing to collaborate, communicate with teachers and stay committed to educational activities, even in flexible digital learning environments [14].

Nevertheless, keeping students motivated in blended learning situations continues to be a serious problem [11]. Lack of interactivity, reduced social presence and the absence of instant feedback can hinder students' motivation and commitment [5]. This is why it is important to understand how students' engagement contributes to enhancing the quality of instruction.

■ 2.4. Resource Allocation and Institutional Support

Allocation of resources is one of the essential supporting elements that contribute to implementing IT-enhanced learning in higher educational institutions [12]. This includes the technological infrastructure, digital learning platforms, Internet connection, technical assistance, and financial investment by educational institutions in their technological infrastructure for teaching purposes.

Proper allocation of resources ensures that universities adopt effective digital learning systems to facilitate the teaching-learning process [3]. Technological infrastructures help institutions provide quality and efficient online learning environments [4].

Nevertheless, technology alone does not necessarily lead to better teaching. In most cases, its success is determined by the manner in which it is implemented in learning activities by teachers and students [15]. Without proper pedagogical approaches and student involvement, the effects of investing in resources might be constrained [5].

This would mean that the allocation of resources will always act as a facilitating variable that works alongside other variables such as the competence of teachers and student engagement.

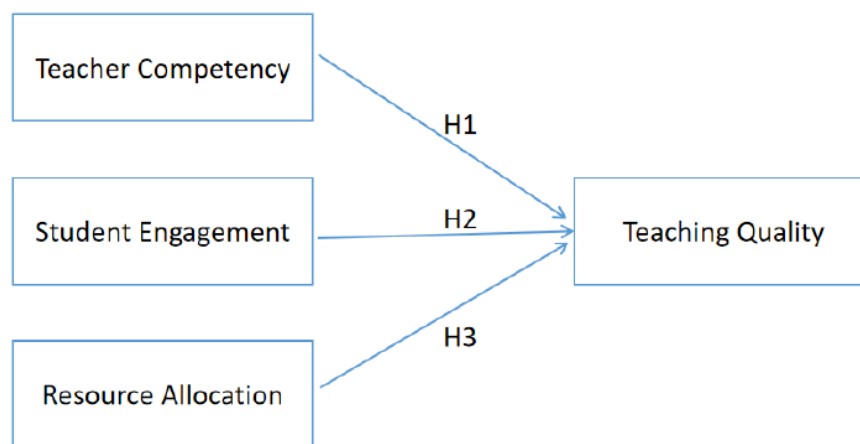


Figure 1: Conceptual Framework of the Study.

■ 2.5. Research Gap and Conceptual Framework

Despite the rich literature in the field of IT-enhanced learning, there are still some shortcomings that require further analysis. One major problem is that most of the literature is mainly concentrated on the usage of the new technologies in teaching, but not on the quality of the process itself [2]. Another problem is that not many studies have considered all three variables together in one model [15].

Moreover, the weight of each factor in determining teaching quality has not yet been clarified properly, especially in the Chinese educational setting [11,12]. The importance of student engagement is often stressed in the literature, but whether it acts as a dominant factor or not is yet to be proven [10].

Consequently, it makes sense to develop a conceptual framework in which the quality of teaching will be influenced by three components mentioned above. It should allow analyzing the weight of each variable separately.

■ 3. METHODOLOGY

■ 3.1. Research Design

A mixed-method research design that predominantly utilized quantitative research methods was applied to examine the factors impacting the quality of teaching in IT-enhanced learning settings in Henan University of Technology [16]. Mixed-methods were applied since it was necessary to achieve a greater depth of knowledge about the studied phenomenon and gain insights through statistical data analysis and academics' experiences and opinions.

The quantitative method was used primarily to analyze the relations between the level of teachers' competence, the involvement of students in the process of learning, allocation of resources for teaching, and the quality of teaching. Qualitative method served as the secondary one and aimed at explaining the results obtained during the statistical analysis.

■ 3.2. Research Participants and Sampling

Quantitative data was obtained from the undergraduate students studying at Henan University of Technology. The number of valid responses received was 180, which was used in the analysis. Convenient sampling was used to choose the participants of the study as it was easier to locate them [17].

Students belonging to different year levels and having experience in learning in IT-enhanced learning environments constituted the sample size. The data obtained was enough for establishing correlations between the variables being considered in the study and performing regression analysis.

For the qualitative data collection, five academic personnel were chosen using purposive sampling technique. Interviewees consisted of people having experience in implementing IT-enhanced teaching methods and practices within higher education institutions.

■ 3.3. Research Instrument

A well-designed survey was created on the basis of previous literature dealing with IT-enhanced learning, teaching quality, engagement level of students, and use

of educational technology. The questionnaire contained four main sections concerning teacher competency, engagement level of students, resource distribution, and teaching quality.

Each item included in the questionnaire was measured with a five-point Likert scale starting with 1 as “Strongly Disagree” and finishing with 5 as “Strongly Agree.” The purpose of the questionnaire was to assess students’ perceptions about effectiveness of an IT-enhanced learning environment and factors influencing teaching quality.

Qualitative interviews were carried out according to the semi-structured interview questions aimed at assessing participant experience in relation to IT-enhanced learning and its implementation. The interviews were also used as an opportunity to explain the results gathered through the questionnaire.

■ 3.4. Data Collection Procedure

The quantitative data collection technique involved conducting questionnaires either online or physically distributed among the undergraduate students of Henan University of Technology. Before embarking on the exercise, all the participants were enlightened on the objective of the research as well as assured of confidentiality regarding their responses.

Qualitative interviews were held with the chosen academic staff members. These were individual interviews, which involved collecting information regarding the experience of the participants with the use of digital teaching techniques.

■ 3.5. Data Analysis

Quantitative data were analyzed using the Statistical Package for the Social Sciences (SPSS). Various statistical tests were applied, such as descriptive

statistics, reliability test, correlation test, and multiple regression analysis.

Descriptive statistics helped describe respondents’ demographics and overall response pattern. To test for the internal consistency of the measurement scales, a reliability test was undertaken. A correlation test was finally conducted to find out whether a relationship exists between teacher competency, student engagement, allocation of resources, and quality of teaching.

The next step was to conduct multiple regression analysis to determine how much influence the independent variables would have on the dependent variable. Regression analysis helped reveal which variable acted as the best predictor of quality of teaching.

In relation to the qualitative part of this research, thematic analysis was used to discover common themes from the interview transcripts. The interpretation of qualitative data focused particularly on quantitative data concerning student engagement and institutional support.

■ 4. RESULTS AND FINDINGS

■ 4.1. Demographic Characteristics of Participants

A total of 180 questionnaires were collected from students studying at Henan University of Technology. The demographic information about the respondents is presented in Table 1.

The number of male respondents was 109 (60.56%), while the number of female respondents was 71 (39.44%), indicating that a relatively larger number of male respondents had participated in the research. In terms of year of academic study, the Year 1 respondents were 26.67%, Year 2 respondents were 25.56%, Year 3 respondents were 23.33%, Year 4 respondents were 19.44%, and Year 5 respondents were 5%. It is important to mention here that the number of respondents

Table 1: Demographic Characteristics of Participants (N = 180)

Variable	Category	n	%
Gender	Male	109	60.56
	Female	71	39.44
Year of Study	Year 1	48	26.67
	Year 2	46	25.56
	Year 3	42	23.33
	Year 4	35	19.44
	Year 5	9	5.00

belonging to Year 5 is very small, perhaps due to delayed completion of academic studies.

The use of a range of respondents at various academic levels enabled gathering a variety of opinions regarding the quality of teaching in the context of a digital learning environment.

■ 4.2. Descriptive Statistics and Correlation Analysis

Descriptive statistics and correlation analysis techniques were used to identify the relationship between teacher competency, student engagement, resource allocation, and teaching quality. The results are shown in Table 2.

According to the data, the highest mean score was noted for the variable related to student engagement ($M = 4.02$; $SD = 0.58$), which means that students' engagement was rather high. Similarly, the score obtained in relation to teaching quality is relatively high ($M = 3.91$; $SD = 0.60$), which implies that participants hold generally positive perceptions in regards to teaching quality in digital learning settings.

As for the variable associated with teacher competency, a score of $M = 3.86$ ($SD = 0.62$) was observed, implying that students perceived teachers' competencies positively. Lastly, the mean value of the variable related to resource allocation was the lowest compared to other variables ($M = 3.65$; $SD = 0.71$).

In particular, there was found to be a statistically significant positive correlation between all of the considered study variables. Thus, teacher competency was found to be positively correlated with student engagement ($r = 0.68$, $p < .001$), resource allocation ($r = 0.62$, $p < .001$), and teaching quality ($r = 0.70$, $p < .001$). Additionally, student engagement was positively correlated with resource allocation ($r = 0.65$, $p < .001$) and teaching quality ($r = 0.81$, $p < .001$).

Of all the studied correlations, the strongest relationship was between student engagement and teaching quality.

Table 2: Means, Standard Deviations, and Correlation Matrix

Variable	Mean	SD	1	2	3	4
1. Teacher Competency	3.86	0.62	1			
2. Student Engagement	4.02	0.58	0.68***	1		
3. Resource Allocation	3.65	0.71	0.62***	0.65***	1	
4. Teaching Quality	3.91	0.60	0.70***	0.81***	0.66***	1

Note: *** $p < .001$

This fact implies that actively participating in educational activities, interacting with online learning material, and developing greater learning motivation leads to improved perception of teaching quality when technology is applied.

At the same time, the positive relationship between resource allocation and teaching quality ($r = 0.66$, $p < .001$) can be explained by increased institutional technological support and additional opportunities for using digital learning resources, which positively influences the learning process and contributes to overall teaching quality.

■ 4.3. Multiple Regression Analysis

Multiple regression analysis was carried out in order to find out the impact of teacher competency, student engagement, and resource allocation on the quality of teaching within IT-aided learning environments. The results of regression analysis are given in Table 3 below.

It is found that all three independent variables had a significant effect on the dependent variable (teaching quality). Out of these, student engagement had the greatest impact on the quality of teaching ($\beta = 0.81$, $t = 12.47$, $p < .001$). It can be interpreted as follows: student engagement and motivation have been found to be crucial for improving the quality of teaching in a digital learning environment.

Teacher competency has also been found to have a statistically significant positive effect on teaching quality ($\beta = 0.21$, $t = 3.25$, $p = .001$). It means that teachers who possess higher levels of technological and pedagogical competency may be expected to deliver more effective teaching.

Moreover, resource allocation had a positive impact on the quality of instruction ($\beta = 0.18$, $t = 2.41$, $p = .017$). Even though resource allocation did not play a major role in the prediction of the quality of teaching compared to student engagement and teacher competency, it can be argued that having sufficient technological resources is essential for digital learning implementation.

Table 3: Multiple Regression Analysis for Teaching Quality

Variable	β	t	p
Teacher Competency	0.21	3.25	0.001
Student Engagement	0.81	12.47	< 0.001
Resource Allocation	0.18	2.41	0.017

Model Summary: $R^2 = 0.658$, $F = 112.36$, $p < .001$

Overall, the regression equation accounted for 65.8% of variance in the quality of teaching ($R^2 = 0.658$), indicating that all three factors are quite significant when it comes to predicting the efficiency of teachers in IT-mediated learning environments. Additionally, the whole model is statistically significant ($F = 112.36$, $p < .001$).

Overall, the results indicate that whereas both teacher competency and resource allocation are important predictors, it was student engagement that had the biggest influence on the quality of teaching in an IT-enhanced learning environment.

■ 4.4. Qualitative Findings

The qualitative evidence was obtained using semi-structured interviews with five academic staff members responsible for implementing IT-enhanced learning. The qualitative results agreed with the quantitative findings and offered additional insights into the factors affecting the quality of teaching in the digital environment.

The majority of participants agreed that one of the key factors of IT-enhanced learning success is active student engagement. As one participant noted, “students can answer questions on their phones during class, and the system provides immediate feedback. This has greatly increased class activity and student focus.” It can be assumed from the findings of the interviews that students participating in discussions, teamwork, and other digital learning activities showed greater motivation and increased their learning efficiency. Another finding of the interviewees was that keeping the interaction and engagement of students remains one of the major difficulties in digital education. Another participant stressed the difficulties in keeping the students motivated during online education, since some students have a tendency to become passive due to lack of personal observation.

In addition to that, the results of the interview indicated that teacher competency plays a crucial role in digital teaching. Educators having higher technological and pedagogical competencies are usually able to develop

effective digital lessons and maintain communication with the learners.

Moreover, institutional support and technological framework were mentioned as essential supporting elements. Some participants noted that online learning platforms, technical support, and professional development initiatives contribute to IT-enhanced learning programs positively. Yet, all participants agreed that only technological tools will not help unless students engage actively and there are effective methods of teaching implemented.

In general, qualitative data supported the results obtained using quantitative measures because it became clear that teacher competency, student involvement, and allocation of resources affect quality of teaching directly. Of all the variables, student involvement turned out to be the one having the most significant impact on teaching quality. The qualitative data added another level to the understanding of the quantitative research findings by offering explanations for the statistically proven connections between the variables. Specifically, the role of student involvement and teacher competency as predictors of teaching quality was identified by the interviewees, corroborating the regression analysis findings.

■ 5. DISCUSSION AND CONCLUSION

■ 5.1. Discussion

The current study aimed at assessing the impact of teacher competency, student engagement, and resource allocation on teaching quality in IT-enhanced learning environments at Henan University of Technology. It can be concluded from the research findings that the three factors mentioned above have a significant impact on teaching quality; however, they do not possess equal power in impacting teaching quality, because, of the three factors mentioned above, student engagement proves to be the most influential one.

The findings indicate that, out of the three variables considered in this research, student engagement is the

most influential factor impacting teaching quality [10,18]. As it was already mentioned in the previous part, IT-enhanced learning environment requires a higher level of activity of students in the process of learning compared to traditional classrooms. In particular, students participating in learning activities using IT-enhanced learning environment should show increased responsibility for their education by being able to plan their learning process, interact with learning material available in the online format, work together with other participants, etc.

Furthermore, student engagement is linked to the wider shift in the approach to learning due to digitalization in higher education. Technology-enabled learning is learner-centered compared to teacher-centered traditional approaches to higher education [19]. On the one hand, digital learning solutions offer learners flexibility and increased autonomy; on the other hand, this flexibility implies that learners should be more responsible and active in the learning process. Consequently, student engagement plays an important role not only as a learning outcome but also as a factor contributing to the achievement of educational goals via digital teaching strategies.

In the context of Chinese higher education, this conclusion has particular significance for understanding the challenges of digitalization at universities. Many Chinese universities have actively invested in advanced online learning solutions, smart classrooms, and digital learning tools in general. Nonetheless, technological development per se cannot lead to improvements in teaching. The results of the current study show that the success of these initiatives relies on active student engagement in learning. Despite the availability of advanced technologies, the impact on teaching may be weak due to students' lack of engagement in learning processes.

Qualitative results, on their part, serve to provide additional evidence for this understanding. In particular, during the interviews, all participants stressed that keeping the students engaged in the process of studying in e-learning and blended formats is one of the most difficult problems to resolve by teachers. Some students become less motivated, participate less often in class, and show less activity in their digital learning environment than they do in the traditional face-to-face classroom setting.

At the same time, based on the data obtained from the interviews, the interview findings indicate that engaged

students are more likely to actively participate in their academic life, communicate with teachers more efficiently, and show more interest in collaborating.

In addition, the research revealed a substantial positive correlation between teacher competency and the quality of teaching. Such a discovery proves the crucial role of the teacher as a facilitator for the success of the digital learning process. The role of the teacher within the digital classroom provided with IT has significantly changed; the teacher should not only be the transmitter of knowledge but also the facilitator of the digital learning process who has to perform several roles of an instructional designer, mentor, and coordinator of the process [7,13]. Consequently, effective instruction depends on the teachers' ability to integrate technological skills with their pedagogical practice based on interaction.

It means that the teacher who demonstrates a high level of competency both from the technological and pedagogical point of view is more capable of designing an interesting teaching practice and adjusting their instruction to the digital learning process. The teacher with such competencies will be able to lead online discussion, give appropriate feedback, apply technological skills, and organize interaction in the classroom [13].

In addition, the findings show that the indirect effects of teacher competency could also be felt from the relationship between the teacher's ability to foster student engagement. A skilled teacher would frequently provide an amiable and interactive learning atmosphere to their students, thereby motivating them and inspiring them to actively engage in their digital learning tasks. This means that not only does teacher competency affect IT-enhanced learning, but it also facilitates teachers' engagement with students.

On the other hand, the resource allocation factor also contributed to the quality of teaching, but not as much as student engagement and teacher competency. The findings shed light on the importance of having adequate technological infrastructure and institutional support for IT-enhanced learning. Institutions require good digital infrastructure, connectivity to the internet, technical support, and learning management systems to ensure proper implementation of IT-enhanced learning.

However, the less significant effect of the predictor resource allocation demonstrates that technology alone is not enough to ensure quality teaching [15,20]. An

additional perspective here would be that the technology resources play an enabling role rather than an instrumental one in determining the teaching efficiency. The key to their successful implementation lies in their effective use by both teachers and learners in the course of education. Technologies can facilitate the learning process, yet their efficacy is contingent on their application by teachers and learners alike. Without proper pedagogic use and engagement in the learning process, any institution's investments in technology would not necessarily translate into effective education.

The relevance of this conclusion lies in the fact that universities which strive to enhance the presence of technology while neglecting the development of pedagogical practices and learner behaviour cannot reap full benefits from such initiatives. In some instances, heavy investments in educational technology have led to the belief that better teaching quality will inevitably ensue. Yet, according to the current research, it appears that human factors are more influential than technological factors [18,21].

The synthesis of quantitative and qualitative data shows that the teaching quality in IT-enhanced learning spaces is multi-dimensional in nature, depending on the interplay between institutional support, instructional competency and active learner involvement. Instead of standing alone from each other, the three factors depend on each other in complicated ways. Technologies are used as the foundation of online learning; the quality of instruction depends on teacher competency; while the achievement of the desired teaching and learning results is dependent upon student engagement.

On the whole, the contribution of this empirical study to existing knowledge about educational technology lies in the proof that student engagement is crucially important for defining the extent to which teaching can be considered of high quality in the realm of digital learning. In accordance with the research findings, universities seeking to enhance their effectiveness of teaching within the context of IT would have to look further than mere technical issues and focus on engaging students in learning [5,22].

■ 5.2. Conclusion

The aim of this study was to examine the various elements that affect the quality of teaching within the context of learning that is technology-enabled in the Henan University of Technology. The adoption of a

mixed-method approach which was quantitatively oriented made it possible to evaluate the effects of teacher competency, learner involvement, and distribution of resources on the quality of teaching.

The results show that each of the mentioned variables has a significant effect on the quality of teaching in IT-enhanced learning environments, but among all the variables, student engagement appears to be the most critical one.

The present study offers contributions both theoretically and practically. Firstly, it contributes theoretically to the current literature on educational technology in the sense that it adds empirical evidence to the topic based on a context in China and that student engagement has been emphasized to be the key element in IT-enhanced learning environment. Practically, it can provide useful information for higher education organizations seeking to improve teaching quality through increasing student engagement efforts, improving teacher digital competency, and ensuring organizational resource support.

In general, this study shows that good teaching in IT-enhanced learning environment relies on proper balance among three key elements: technological resource, teacher competency, and student engagement. Student engagement is particularly vital to successful digital learning implementation in higher education. Therefore, universities should adopt an integrated approach that combines student engagement, teacher competency, and institutional support to achieve sustainable improvements in teaching quality within IT-enhanced learning environments.

■ 5.3. Practical Implications

The empirical results of this research have a number of useful practical implications for educational institutions looking to foster the teaching process through enhanced use of information technology. The first conclusion that can be drawn from this analysis is that student engagement exerts a significant impact on the effectiveness of IT use in the context of learning. As such, universities must focus on finding ways to motivate learners, as well as develop their skills and competencies needed for successful learning. Consequently, universities must create an environment that will promote collaborative learning, interaction, and active student involvement in all cases. The list of such tools might include discussion boards, collaborative work

assignments, interactive quizzing tools, gaming techniques in learning, and feedback mechanisms that would stimulate engagement. From the perspective of university policies, the institutions might offer regular professional development for instructors and appropriate resource assistance to facilitate more efficient teaching in technology-enabled education.

Another implication that can be derived from the presented analysis relates to teacher competency, which turned out to exert a significant effect on student performance in the case under discussion. In order to increase students' academic achievements in relation to courses involving the use of information technology, universities must ensure ongoing professional development of their staff members, providing training programs that would help them hone their skills and abilities to work with various types of digital technology.

Third, it appears that while the institutions have allocated resources to investing in technological infrastructures, they need also to implement supportive pedagogical and instructional approaches. While resource allocation positively affects teaching quality, the findings reveal that the use of technology alone is not enough to guarantee positive learning outcomes. Universities should adopt a more integrated strategy that combines investments in technology with teachers' training, adjustments in curricula, and students' involvement.

Moreover, universities can provide more robust academic assistance to facilitate adjustment to IT-enhanced learning environments for learners. Indeed, there are several issues that students can face when they participate in learning activities in technology-supported environments. These include motivational issues, poor time-management skills, lack of self-discipline, as well as problems associated with interactions within such settings.

The results of this research can be applied by policy makers in education, as well as university administrators, who have implemented or are planning the implementation of their institutions' digital transformations. As technology-based learning expands, emphasis needs to be put on the human factors of digital learning, such as students' behavior during the learning process and instruction. Thus, when developing policies to improve teaching quality, technology should not be seen as the main aspect. More focus needs to be paid to fostering students' involvement in the learning process and improving teachers' competence.

In summary, this study has shown that improvements in the quality of teaching using IT-enhanced learning should be approached in a holistic manner and with an emphasis on students. For a sustainable improvement in the field of digital learning, reliance on technological innovation alone is not enough.

■ 5.4. Limitations and Future Research

However, there are certain limitations that need to be discussed in relation to this study. Firstly, the study was based on the sample of one higher education institution, Henan University of Technology. Though the findings can serve as a useful reference for understanding IT-enhanced learning in China, the data may not generalize to other universities or regions in China. Thus, future research can consider the expansion of the study population by involving various higher education institutions in China.

Secondly, the research is based on the use of the cross-sectional design where the data collection was conducted during a particular period of time. Consequently, the data obtained from this study may not reflect changes related to student engagement, teacher competency, and teaching quality that take place during the process of technology-supported learning implementation. Due to the rapid evolution of digital learning environments, future studies may employ a longitudinal design.

Third, the collection of quantitative data was mainly based on self-reporting perceptions provided by the students through the use of questionnaires. Although the practice of using self-reports is common practice in the field of education, self-reports might be affected by various forms of biases, interpretations, and responses. Future researchers may consider using more sources of data, such as observational measures or students' performance records, to make more accurate assessments of teachers' performance.

Besides, the current study considered only three major determinants of the quality of teaching, which included teacher competency, learner engagement, and allocation of resources. There might be many other variables, which are important for measuring teacher effectiveness in the environment of digital learning. Future researchers may examine some of these variables and analyze whether there are any mediation or moderation effects between these variables.

Finally, it is shown that one of the most important variables affecting the assessment of teaching quality in

IT-enhanced learning is student engagement. Future researchers can also look into different dimensions of student engagement, including behavioral, emotional, and cognitive dimensions of engagement.

■ List of Abbreviations

IT	Information Technology
TPACK	Technological Pedagogical Content Knowledge
EFA	Exploratory Factor Analysis
KMO	Kaiser–Meyer–Olkin
SD	Standard Deviation
SDG	Sustainable Development Goal
R²	R-squared

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■ CONFLICT OF INTEREST

The authors declare no conflict of interest.

■ AUTHOR CONTRIBUTION FORM

Author Name	Role / Contribution
Wang Yun	Conceptualization, Methodology, Investigation, Formal Analysis, Data Collection, Writing – Original Draft, Writing – Review & Editing, Project Coordination
Yu YINUO	Literature Review, Data Curation, Validation, Writing – Review & Editing, Resources
Wang Siran	Review & Editing, Academic Guidance from International Perspectives
Kamolrat Intaratat	Expert Consultation, International Perspective, Methodological Advice, Critical Review, Editorial Support

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