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Research Article

Impact of TOC (Teacher Organizational Commitment) and VTLE (Virtual Teaching Learning Environment) on Teachers' Innovative Work Behavior (TIWB) Influencing ICT Skills and Employees Creativity

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ABSTRACT

The use of technology in education has challenged traditional paradigms of teaching and learning, resulting in instructor adaptability and creativity. The rapid advancement of digitalization has resulted in an unparalleled array of tools and platforms that educators can employ to augment the learning process. Consequently, the objective of this study was to examine the relationships among teacher organizational commitment (TOC), teachers' innovative work behavior (TIWB), virtual teaching-learning environments (VTLE), employee creativity and ICT abilities. It also explored how technology readiness and virtual integration play a moderating influence. A quantitative study approach was used, with a broad sample of teachers from various educational institutions participating. Data was collected from 502 teachers using validated self-report surveys that measured the dimensions under research. The variables' relationships were examined using structural equation modeling. The results showed that teacher organizational commitment and creative work behavior are positively correlated. Virtual teaching-learning environments were discovered to have a considerable impact on innovative work behavior. ICT skills and employee creativity strongly were associated with innovative work behavior. Furthermore, virtual integration and technological readiness were recognized as important moderators that shape the interactions between commitment, virtual environments, innovation, and creativity. This study advances our understanding of the interactions between technology, commitment, innovation, and virtual worlds in influencing instructors' behavior. It emphasizes the significance of dedication and technological integration in promoting innovative teaching techniques. The study provides guidance for educators, educational organizations, and legislators who want to improve education in the digital era.

Keywords: Teacher Organizational Commitment (TOC), Virtual Teaching-Learning Environments (VTLE), Teachers' Innovative Work Behavior (TIWB), ICT Skills, Employee Creativity.

INTRODUCTION

Technology integration in education has seen a tremendous transition in recent years, providing educators with both opportunities and problems. Teachers are now equipped with a plethora of digital tools and online platforms that can enhance their instructional approaches and engage students in novel ways in this digitally

driven age. Interactive simulations, multimedia presentations, and virtual field trips, for example, have become modern classroom staples, enabling immersive learning experiences. However, increased technological integration necessitates that instructors not only learn how to use these tools effectively but also how to negotiate the quickly changing world of educational technology. Teachers in today's dynamic educational landscape are not just conveying knowledge but also cultivating a culture of innovative behavior and developing vital information and communication technology (ICT) skills in pupils. It has important ramifications for employee creativity in a wider professional context that there is a symbiotic relationship between new education methods and ICT competence.

Teachers act as catalysts for cultivating innovative student behavior by employing creative teaching strategies that transcend conventional paradigms. educators teach students to think critically, embrace experimentation, and build imaginative problem-solving abilities through project-based learning, interactive debates, and collaborative assignments (Belda-Medina, 2022). These traits, which are ingrained from a young age, become essential components of students' professional identities and foster employee creativity in their future employment. In addition, integrating ICT skills into education is a critical component of educating students in the digital age (Vellanki, Mond, Khan, & Nair, 2022). From basic digital literacy to more complex abilities like coding and data analysis, teachers are crucial in helping children develop a spectrum of digital talents. Teachers encourage students to grasp the potential of ICT by including technology-rich activities and harnessing digital tools (Al Chibani, 2019). In addition to supporting academic development, these abilities put students in a position to become technologically savvy workers who can use technology to innovate and advance organizations.

The function of teachers as knowledge providers and facilitators assumes a new dimension in the context of this technological revolution. Innovative work behavior and originality among instructors are crucial in creating an environment that encourages critical thinking and problem-solving skills in pupils (LaForett & De Marco, 2020). encouraging teachers to try out new teaching methods and curricular approaches can increase student interest and engagement, resulting in more effective learning results. Furthermore, students are more likely to develop a mentality of curiosity and open-mindedness qualities that are becoming increasingly important in a society that is always changing, when teachers themselves exhibit innovative behavior (Gomes & Fleer, 2020). As a result, cultivating a creative culture among educators not only improves teaching methods but also adds to the larger educational ecosystem.

The concept of virtual teaching-learning environments has arisen as a strategic reaction to the changing dynamics of the educational landscape. According to Anksorus et al. (2021), these environments combine conventional classroom settings with digital resources and interactive technologies to produce a dynamic environment that transcends physical limitations. The introduction of virtual aspects into education allows for greater access flexibility, allowing students from varied backgrounds to participate in collaborative learning experiences (Kang & Lee, 2020). This is especially important in situations where physical attendance is limited, such as during pandemics, where virtual platforms have functioned as a lifeline for educational continuity (Hodges et al., 2020). As a result, educators must modify their pedagogical practices in order to effectively traverse and harness the potential of virtual teaching-learning environments, highlighting the significance of providing both teachers and students with digital literacy skills.

Teacher organizational commitment is crucial in developing an innovative culture inside educational institutions. When instructors have a strong attachment and devotion to their school or institution, they are more inclined to engage in innovative methods proactively (Meyer, Morin, Stanley, & Maltin, 2019). Teachers are inspired to put time and effort into experimenting with new teaching approaches and embracing change when there is a high level of teacher organizational commitment. This dedication is fostered by an institutional culture that encourages educators to share ideas, engage in peer mentoring, and participate in professional development activities (Auletto, 2021). A stronger teacher organizational commitment not only encourages teachers to experiment with new teaching methods, but also leads to a positive cycle of continual development in which innovative work behavior gets ingrained in the institution's fabric.

Many studies have examined the relationship between technology and education, highlighting how the use of digital tools in contemporary classrooms has the potential to completely change learning. (Loi & Thanh, 2022) investigated how technology integration improves student engagement, collaboration, and knowledge retention. Furthermore, research into innovative teaching approaches has revealed that educators play a critical role in constructing effective digital learning experiences (Fondo & Gómez-Rey, 2021). These findings, taken together, highlight the need for educators to adapt, innovate, and fully utilize technology. In the area of teacher creativity, research has highlighted the necessity of encouraging innovative work behavior to develop richer learning environments (Palacios Hidalgo, Gómez Parra, & Huertas Abril, 2020). Additionally, studies on teacher organizational commitment have looked at how it affects student performance and job satisfaction in teachers

(Wayoi, Margana, Prasojo, & Habibi, 2021), suggesting a potential link to creative work practices.

Despite this body of evidence, certain gaps in comprehending the intricate interactions between teacher organizational commitment, virtual teaching-learning settings, innovative work behavior, ICT abilities, and employee creativity remain. The interdependence of these aspects within the changing educational landscape has frequently been ignored in previous studies, which frequently looked at these dimensions separately. The specific relationship between teacher organizational commitment and the adoption of innovative work behavior, especially in the setting of technology-mediated instruction, has received little attention. Although studies on the influence of technology on teaching practices and its relationship to teacher commitment have been conducted, a comprehensive understanding of how commitment affects the adoption of innovative practices in a digital context is still lacking. As a result, the purpose of this study is to fill research gaps by unraveling the complicated relationships between these dimensions, revealing light on how technology, dedication, innovation, and virtual environments intersect and influence each other in today's educational scene. This study aims to achieve the following objectives:

To examine the relationship between teacher organizational commitment and innovative work behavior.

To explore the impact of virtual teaching-learning environments on innovative work behavior.

To Investigate the mediating role of ICT skills in the relationship between teacher organizational commitment and innovative work behavior.

To examine the relationship between innovative work behavior and employee creativity.

To Investigate the moderating role of virtual integration between teacher organizational commitment and teacher innovative work behavior, and virtual teaching learning environment and teachers' innovative work behavior.

To Investigate the moderating role of technological readiness between teachers' innovative work behavior and ICT Skills, and teachers' innovative work behavior and employee creativity.

This study is highly significant for improving our understanding of teacher behavior in technology-enhanced learning environments. Understanding how teacher organizational commitment, virtual teaching-learning settings, and innovative work behavior intersect is critical as technology becomes a vital feature of modern education. The study will shed light on the relationships between these dimensions and provide an understanding of the forces that influence teachers' reactions to the evolving educational landscape. It tries to determine whether dedication serves as a catalyst for innovation and how virtual environments influence instructors' creative teaching approaches. For educators, educational researchers, and other stakeholders hoping to properly utilize technology's potential and foster innovation in educational contexts, a greater grasp of the topic is essential.

LITERATURE REVIEW

Teacher Organizational Commitment and Teacher Innovative Behavior

Teacher organizational commitment refers to the extent to which instructors exhibit a sense of identification and loyalty towards their school and the teaching profession. The influence of teacher-student interactions, also known as teacher-student relationship quality, has been extensively researched and found to have significant implications on a variety of outcomes, including teacher retention, student achievement, and teacher well-being (Harvey, Lemelin, & Déry, 2022). Nevertheless, a less explored consequence pertains to teacher innovative behavior (TIB), which refers to the degree to which educators produce and execute novel concepts aimed at enhancing their instructional methods and fostering student learning. Peláez-Fernández, Mérida-López, Rey, and Extremera (2022) found that teacher dedication to their organization increases work engagement. Work engagement inspires creativity and innovation in educators. Liou, Canrinus, and Daly (2019) measured TIB using a unique planned behavior technique. Teachers' TIB attitudes, subjective norms, perceived behavioral control, and intents were examined. They also used reports from their administration to gather information on teachers' actual TIB. The level of commitment of teachers to their school was measured using a single-item scale to further quantify TOC. Palacios Hidalgo et al. (2020) found that teacher organizational commitment (TOC) had a positive effect on educators' beliefs, subjective norms, perceived behavioral control, intentions, and actual implementation of teachers' innovative work behavior (TIWB). According to Pasricha, Nivedhitha, and Raghuvanshi (2023), it was proposed that educators who have a strong dedication to their educational institution likely to possess more favorable attitudes and beliefs towards TIB. Additionally, these individuals tend to experience greater social pressure and support to actively participate in TIB. Moreover, they sense a higher level of control over their own

conduct and express a greater intention to engage in TIB on a more frequent basis.

H1: Teacher organizational commitment significantly and positively impacts teacher innovative behavior.

Virtual Teaching-Learning Environment and Teacher Innovative Behavior

The utilization of digital technology and platforms to aid and enhance the educational process is commonly referred to as a virtual teaching-learning environment (VTLE). VTLE can offer a variety of advantages, including enhanced access, flexibility, interactivity, collaboration, and personalization (Cao & AlKubaisy, 2022). The degree to which teachers develop and put into practice fresh ideas to enhance their teaching methods and student learning is supported by VTLE as well. Ma, Chen, Zheng, and Wu (2022) conducted a separate investigation employing an alternative methodology to assess VTLE, drawing upon the theoretical framework of virtual learning environments. Ceallaigh (2022) evaluated the educators' perspectives on four distinct aspects of Virtual Teaching and Learning environments (VTLE): presence, interactivity, structure, and feedback. Two variables were utilized to quantify TIWB: teacher involvement in decision-making and teacher professional development. The researchers discovered that Virtual Teacher Learning environments (VTLE) had a beneficial impact on Technology Integration in Whole-Brain (TIWB) teaching approaches. Tan, Chan, and Mohd Said (2021) discovered that the implementation of digital transformation yielded favorable outcomes for both Teacher organizational commitment (TOC) and teacher Innovation Work Behavior (TIWB). Furthermore, the study revealed that TOC played a mediating role in the relationship between digital transformation and its impact on TIWB. A significant degree of digital transformation has a positive impact on teachers' dedication to their school and occupation. Consequently, this heightened commitment serves as a catalyst for their active involvement in decision-making processes and engagement in professional development endeavors.

H2: Virtual teaching-learning environment significantly and positively impacts teachers' innovative work behavior.

Teachers' Innovative Work Behavior and ICT Skills

ICT abilities refer to the aptitude to proficiently and innovatively utilize information and communication technology (ICT) across diverse settings. Information and Communication Technology (ICT) abilities are imperative for educators in order to improve their pedagogical approaches, ease student learning, and avail themselves of professional growth prospects (Palacios Hidalgo et al., 2020). The level of a teacher's work engagement reflects how enthusiastic, committed, and immersed they are in their profession. According to Habibi, Razak, Yusop, and Mukminin (2019), learning organizations can promote ICT skills by giving teachers opportunities for embedded systems, team learning, and continuous learning. The proactive adoption of new teaching techniques, technological integration, curriculum adaptability, and individualized learning strategies are all examples of innovative work behavior among instructors. Together, these components aid students in honing their ICT abilities. Innovative teachers employ pedagogical strategies like project-based learning, gamification, and group projects to engage students and help them develop their critical thinking and problem-solving abilities (Jodoi, Takenaka, Uchida, Nakagawa, & Inoue, 2021). By properly integrating ICT tools and resources into their lesson, teachers may assist students in acquiring digital literacy skills and becoming adept at using technology for communication, information retrieval, and content creation (Srimadhaven et al., 2020). Additionally, the interdisciplinary character of innovative practices encourages a comprehensive understanding and application of ICT throughout courses, while individualized learning fosters an attitude of progress and adaptation. Innovative work behavior is influenced by a variety of factors, including teacher autonomy, professional development, administrative support, and access to technology.

H3: Teachers' innovative work behavior significantly and positively impacts ICT skills.

Teachers' Innovative Work Behavior and Employees' Creativity

employee creativity refers to an individual's ability to develop unique and valuable concepts or solutions in a variety of sectors. employee creativity is critical to improving organizational performance, encouraging competitiveness, and driving innovation. Teachers with innovative qualities play a critical role in fostering and molding employees' creative capacities in the setting of a company. According to Saether (2019), educators who incorporate creative strategies into their instructional practices promote an environment of psychological safety and openness, hence fostering employee creativity development. This assertion is also supported by the research of Gomes and Fleer (2020), in which the author emphasizes the importance of a teacher's willingness to experiment with new ideas and procedures, as it has the potential to motivate employees to adopt new ideas and solutions. Pioneering educators serve as role models for their colleagues in the field of education, thereby illustrating the need to embrace uncertainty and push into uncharted regions. The teaching strategies used by the individuals in question, according to Amedome (2023), are dynamic. These tactics have been demonstrated to improve employees' cognitive flexibility, encouraging critical thinking and the ability to adapt to changing

situations. According to Sabiri (2020), teachers who use technology and interactive activities inspire employees to approach their work in a similar manner. Innovative teaching goes beyond knowledge transfer. According to Javed, Iqbal, Iqbal, and Imran (2021), it promotes curiosity and experimentation. Teachers who encourage open discourse, embrace multiple opinions and provide constructive criticism inspire employees to share their creative ideas without judgment. This inclusive environment fostered creative organizational solutions.

H4: Teachers' innovative work behavior significantly and positively impacts an employee's creativity.

Virtual Integration as Moderator

The amount to which educators use digital tools and platforms to communicate, collaborate, and coordinate with their peers, students, and other relevant individuals or groups is referred to as virtual integration (VI). Virtual instruction (VI) has numerous benefits, including increased accessibility, adaptability, interactivity, diversity, and efficiency (Büth, Juraschek, Sangwan, Herrmann, & Thiede, 2020). Furthermore, VI facilitates the interchange of knowledge, social support, feedback, and creativity in support of TOC and TIWB. Teacher organizational commitment (TOC) has been recognized as an important element impacting teachers' innovative work behavior (TIWB) among educators (Palacios Hidalgo et al., 2020). TOC refers to a strong emotional bond between instructors and their educational institution, as well as a shared vision, objectives, and ideals (Aguilar, Bordons, & Arce, 2021). Teachers are deeply committed to their educational institutions, which frequently encourages them to actively and innovatively participate in activities that not only improve their own instructional techniques but also improve the educational experiences of their pupils (Al-Husban, 2020). The level of virtual integration that exists within the educational setting has a significant impact on the degree to which this relationship is displayed. Dedicated educators in technologically sophisticated educational environments, typified by a heavy emphasis on virtual instruction (VI), are given a varied range of digital tools and platforms that enable them to efficiently implement their innovative ideas (Human, Basson, & Kruger, 2023). Technology, collaborative virtual environments, and interactive materials give educators the resources they need to study creative teaching techniques, experiment with non-traditional pedagogies, and create engaging curricula. These digitally immersive environments foster a synergistic interaction between TOC and TIWB, which may improve educational experiences. Lo et al. (2020) emphasized VI's crucial role in determining the degree and character of the TOC-TIWB relationship in varied educational situations. VI-embracing instructors have a variety of digital tools to encourage experimentation, cooperation, and creativity. Technology-enhanced platforms allow teachers to cross borders, supporting new approaches. This technology-driven environment boosts instructors' creativity and teacher organizational commitment to innovative work. (Chang, Hsu, & Jong, 2020) studied the relationship between virtual teaching and learning environment and teachers' innovative work behavior in educators. They found that virtual integration significantly moderates the association between VTL and IWB. Teachers with high levels of virtual integration reported a more dramatic impact on their innovative work behavior. experts in technology integration and efficient digital tools utilization were more likely to exhibit innovative work behavior.

H5: Virtual integration moderates the relationship between teacher organizational commitment and teachers' innovative work behavior.

H6: Virtual integration moderates the relationship between the virtual teaching-learning environment and the teacher's innovative work behavior.

Technological Readiness as Moderator

Technological readiness (TR) is an individual's ability to adopt and effectively utilize technology, influenced by attitudes, beliefs, self-efficacy, and comfort levels. Teachers' technical preparedness significantly impacts their ability to engage in innovative work behavior and utilize ICT skills in the educational sphere (Li, 2022). A person's readiness to adopt innovation depends on how they view it and themselves. Thus, the technological readiness of educators may be more likely to innovate. This readiness could synergistically boost their ICT abilities, enabling a cycle of ongoing progress and adaptation. Chwiłkowska-Kubala, Cyfert, Malewska, Mierzejewska, and Szumowski (2023) showed that technological preparedness moderates the relationship between innovative work behavior and ICT abilities. This analysis found a link between instructors' propensity to incorporate technology into their teaching practices and their level of technological readiness. These technologically advanced educators also displayed a penchant for creative work behavior, supporting the theoretical framework's tenets.

Technology readiness has been considered as a key factor in determining a person's ability to effectively use digital tools and platforms. This preparedness includes not only the technical competence to deal with technology but also the psychological disposition and adaptability that people display towards its incorporation, according to Höyng and Lau (2023). In this context, technological readiness plays a key role in determining how well people can use technology to support creative problem-solving and innovative work practices. In addition, creative thinking is significantly influenced by innovative work practices in both academic and professional settings (Wolf

& McCoy, 2019). Innovation in the workplace is often observed when employees engage in active participation in various activities such as idea development, creative problem-solving, and the implementation of novel solutions. Empirical research conducted in diverse domains has provided substantial evidence supporting the crucial relationship between technological preparedness and innovative work behavior. The study done by Duan, Jia, and Chen (2022) provided significant insights into the relationship between educators' preparation for technology and their ability to effectively incorporate technology into their teaching methods. This integration serves to strengthen the fundamental aspects of innovative work behavior while also establishing the necessary conditions for cultivating a creative educational environment.

H7: Technological readiness moderates the relationship between teachers' innovative work behavior and ICT skills.

H8: Technological Readiness moderates the relationship between teachers' innovative work behavior and employee's creativity.

THEORETICAL FRAMEWORK

The theoretical framework put forward in this study carefully considers the interactions between teacher organizational commitment, online teaching and learning settings, creative employee behavior, innovative work practices, and ICT abilities. The model provides a comprehensive framework for comprehending contemporary work dynamics, drawing on insights from organizational psychology, educational technology, and innovation studies. The model's fundamental idea is that teacher organizational commitment serves as a fundamental force that influences both the virtual teaching-learning environment and innovative work practices. Strong dedication to the organization motivates employees to actively participate in the virtual teaching-learning environment, where they can access resources, collaborate, and participate in enlightening online learning experiences. An encouraging virtual teaching-learning environment in turn fosters employees' loyalty to the company. In addition, the model posits that a virtual teaching-learning environment acts as a catalyst for encouraging innovative work behavior. As employees engage in immersive online learning experiences, they gain new skills and knowledge, which enhances their ability to generate innovative ideas and strategies. The model also emphasizes how organizations' commitment to innovation can directly affect their employees' behavior at work. emotionally invested employees are more likely to invest discretionary effort, take calculated risks, and pursue innovative avenues, thereby contributing to a culture of continuous innovation. According to the approach, ICT proficiency is a crucial intermediary component that facilitates the influence of teacher organizational commitment and a virtual teaching-learning environment on staff members' creative thinking. Stronger commitment and engagement in the virtual teaching-learning environment result in improved ICT competencies, allowing employees to utilize digital tools and platforms for creative expression. In addition, the model emphasizes the link between innovative work behavior and employee creativity. Innovative work practices not only produce original ideas but also encourage experimentation, discovery, and risk-taking, which hone the creative abilities of the workforce. On this basis, the conceptual framework (**Figure 1**) was developed.

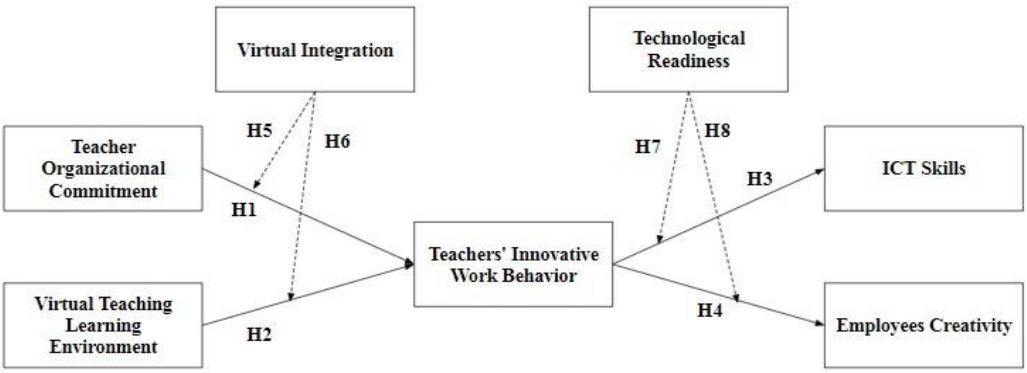

Figure 1. Conceptual Framework

METHODOLOGY

Research Design: A quantitative research design was employed to investigate the relationships among teacher organizational commitment, the virtual teaching-learning environment, teachers' innovative work behavior, ICT skills, employee creativity, virtual integration, and technological readiness.

Population: The population of interest consisted of teachers across various educational institutions at different levels.

Sample Size: The sample size was determined using the rule of thumb for structural equation modeling (SeM), which suggests that a sample size of 5 to 10 times the number of variables provides a reasonable balance between model complexity and statistical power. Given the complexity of the model with several latent variables, a sample size of 700 was deemed appropriate. But out of 700, we received only 502 completely filled questionnaires.

Sampling Technique: A stratified random sampling technique was utilized to ensure representation from various educational levels. The population was divided into strata based on education levels (e.g., primary, secondary, tertiary), and a random sample was drawn from each stratum.

Data Collection Technique: Data were collected through an online questionnaire distributed to the selected participants. The questionnaire was designed to capture responses related to teacher organizational commitment, virtual teaching-learning environment, innovative work behavior, ICT skills, employee creativity, virtual integration, and technological readiness. The use of an online questionnaire allowed for efficient data collection and minimized geographical constraints.

Data Analysis Technique: The collected data were analyzed using SmartPLS 4 software, which is a robust tool for structural equation modeling. Confirmatory factor analysis (CFA) was conducted to assess the validity and reliability of the measurement instruments. Structural equation modeling (SeM) was employed to test the hypothesized relationships between constructs. Path analysis was used to examine the direct and indirect effects. Interaction effects of virtual integration and technological readiness were assessed as moderating variables using Smart PLS 4's capabilities.

RESULTS

Assessment of Measurement and Structural Model

Compared to covariance-based structural equation modeling (CB-SeM) and software programs such as AMOS, SmartPLS has distinct advantages that make it an attractive choice for academicians seeking a user-friendly and flexible method of structural equation modeling (Shmueli et al., 2019). SmartPLS adopts a non-parametric method, making it robust in handling smaller sample sizes and data that do not perfectly follow the normal distribution, in contrast to CB-SeM, which assumes a specific data distribution and necessitates large sample sizes to produce reliable results (Iqbal et al., 2021). Furthermore, SmartPLS provides a graphical user interface for the modeling process, which makes it easier to use for researchers who lack considerable statistical skills. The software's user-friendliness allows researchers to quickly develop and alter models, making it particularly ideal for individuals in the early stages of their research journey or with time restrictions (Greenland, Saleem, Misra, Nguyen, & Mason, 2023). This study used SmartPLS 4 as the data analysis tool. The evaluation of measurement and structural models using the SmartPLS software is a crucial step in confirming the accuracy and validity of a research framework. To begin, the measurement model assessment entails a thorough examination of the latent constructs' internal consistency and reliability. Cronbach's alpha and composite reliability are used as key indications to guarantee that the indicators representing each construct consistently measure the desired idea. Furthermore, convergent and discriminant validity are critical validation elements since they illustrate the distinctness of the notions and their converging measurement outputs. examining factor loadings, average variance extracted (AVE), and the Fornell-Larcker criterion, which jointly affirms the sufficiency of the measurement model's reliability and validity, are used to do this. Moving on to the structural model evaluation, the emphasis changes to studying the links between constructs and determining their relevance. The intensity and direction of these linkages are depicted by the path coefficients in the structural model. Bootstrapping techniques are frequently used to assess the robustness of these relationships. These methods enable the estimation of the path coefficients' statistical significance by resampling the dataset several times and supplying confidence intervals for the path coefficients (**Figure 2**).

Construct Reliability and Validity

The reliability and convergent validity evaluation for the various latent constructs included in this study, including Teacher Organizational Commitment (TOC), Virtual Teaching-Learning environments (VTLE), Teacher Innovative Work Behavior (TIWB), ICT Skills (ICTS), employee Creativity (EC), Virtual Integration (VI), and Technological Readiness (TR), are detailed in **Table 1**. This extensive analysis is critical in establishing the credibility and robustness of the study's measurement model, which serves as the foundation for further structural analysis. The importance of the strength of the connections between observed indicators and their corresponding latent constructs, as captured by outer loadings, further supports the robustness of the constructs. The outer loading values for the structures TOC, VTLE, TIWB, ICTS, EC, VI, and TR range from 0.713 to 0.892 for distinct objects. Additionally, all items outperform the recommended criterion of 0.7 (Iqbal et al., 2021), indicating that the constructs are effective in encapsulating the theoretical aspects that they are intended to evaluate.

By using Cronbach's alpha coefficients, one of the fundamental aspects of construct assessment, reliability evaluation, is made easier. Surprisingly, each construct - TOC, VTLE, TIWB, ICTS, EC, VI, and TR - exceeds the commonly accepted criterion of 0.7 (Alwan & Alshurideh, 2022). The finding indicates a noteworthy level of internal consistency within the constructions, implying a reliable representation of the underlying concept. Simply said, the items inside each construct consistently assess the same latent construct, boosting the measurement model's overall trustworthiness. Moreover, all constructs have Composite Reliability values that consistently exceed the suggested cutoff point of 0.7 (Wei, Gong, Xu, Abidin, & Apuke, 2023), which incorporates shared variation and measurement error. This observation adds to the measurement model's internal consistency and reliability. The Average Variance extracted (AVE) method achieves the rigorous evaluation of convergent validity, which is a cornerstone in confirming the coherence across items within each concept. All constructs, including TOC, VTLE, TIWB, ICTS, EC, VI, and TR, clearly exceed the mandated threshold of 0.5, confirming the successful convergence of items within each construct (Ahmad, Hashmi, Ali, & Faheem, 2021). This demonstrates the constructs' ability to successfully encapsulate the underlying theoretical ideas. In addition, the analysis of multicollinearity issues, as measured by the Variance Inflation Factor (VIF), reveals that each construct comfortably maintains values below the critical threshold of 5 (Shmueli et al., 2019), indicating that there is little chance that multicollinearity will negatively impact the model (**Table 1**).

Table 1. Reliability and Convergent Validity of the Study Constructs

Construct	Item	Outer Loadings	VIF	Alpha	Roh-a	Composite Reliability	AVE
EC	EC1	0.804	2.215	0.897	0.902	0.921	0.659
	EC2	0.848	2.517				
	EC3	0.813	2.362				
	EC4	0.813	2.283				
	EC5	0.756	1.807				
	EC6	0.834	2.313				
ICTS	ICTS1	0.799	2.360	0.907	0.910	0.923	0.573
	ICTS2	0.777	2.576				
	ICTS3	0.751	1.969				
	ICTS4	0.774	2.133				
	ICTS5	0.824	2.630				
	ICTS6	0.724	2.086				
	ICTS7	0.713	1.885				
	ICTS8	0.735	2.098				
	ICTS9	0.707	1.846				
TIWB	TIWB1	0.805	1.830	0.859	0.860	0.904	0.703
	TIWB2	0.867	2.339				
	TIWB3	0.810	1.748				
	TIWB4	0.870	2.442				

Construct	Item	Outer Loadings	VIF	Alpha	Roh-a	Composite Reliability	AVE
TOC	TOC1	0.872	2.954	0.925	0.929	0.941	0.727
	TOC2	0.840	2.297				
	TOC3	0.890	3.477				
	TOC4	0.814	2.244				
	TOC5	0.880	3.328				
	TOC6	0.815	2.364				
TR	TR1	0.839	2.331	0.909	0.909	0.932	0.733
	TR2	0.837	2.218				
	TR3	0.851	2.507				
	TR4	0.862	2.733				
	TR5	0.892	3.215				
VI	VI1	0.843	2.367	0.882	0.883	0.919	0.739
	VI2	0.881	2.728				
	VI3	0.864	2.464				
	VI4	0.850	2.326				
VTLE	VTLE1	0.841	2.393	0.923	0.924	0.940	0.722
	VTLE2	0.836	2.521				
	VTLE3	0.871	2.986				
	VTLE4	0.876	3.079				
	VTLE5	0.859	2.804				
	VTLE6	0.814	2.240				

Note: TOC = Teacher Organizational Commitment, VTLE = Virtual Teaching-Learning Environments, TIWB = Teachers' Innovative Work Behavior, ICTS = ICT Skills, EC = Employee Creativity, VI = Virtual Integration, TR = Technological Readiness.

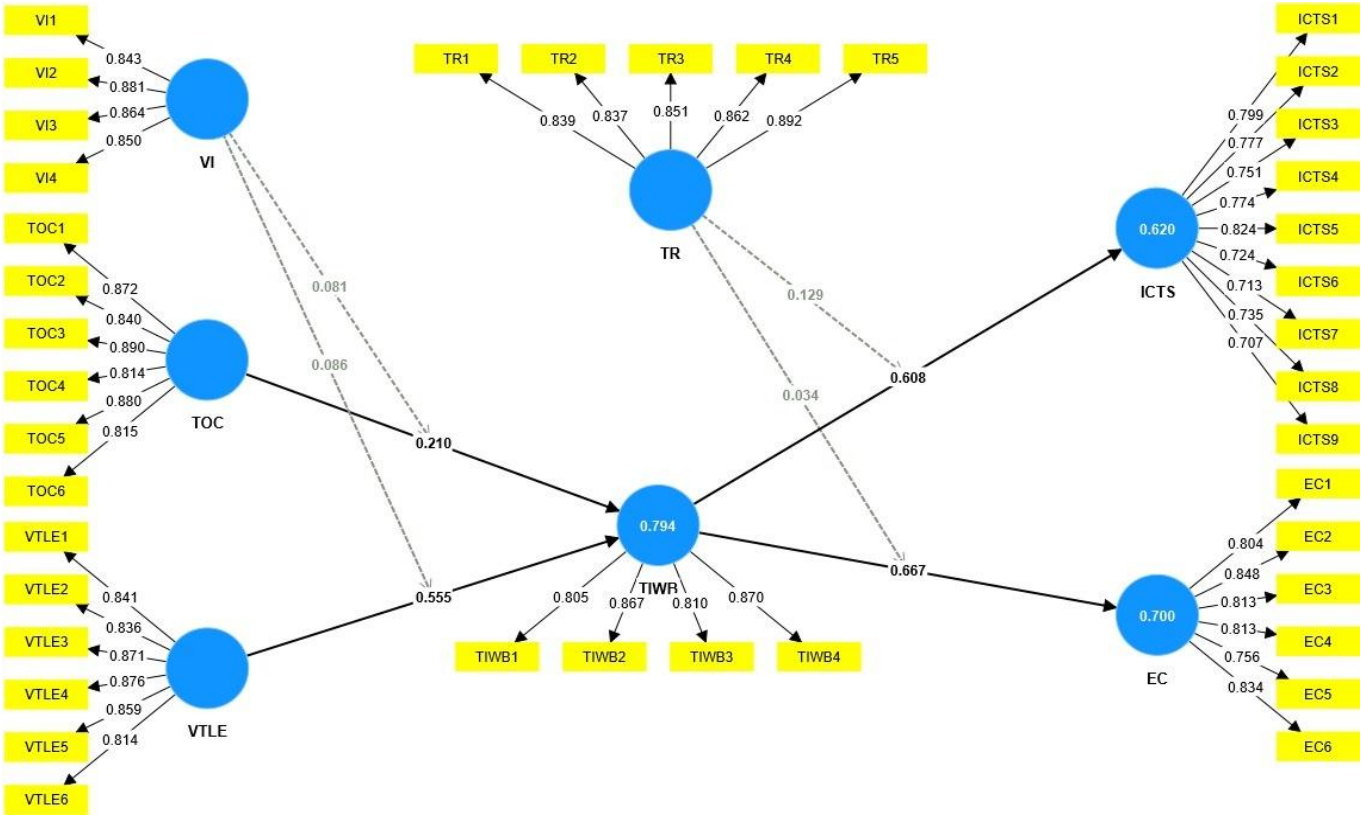

Figure 2. Path Estimates and Outer Loadings

Discriminant Validity

Discriminant validity is an important notion in measurement model evaluation because it ensures that distinct constructs within a study capture unique theoretical concepts rather than overlapping. An approach that is frequently used for assessing this characteristic is the Fornell-Larcker criterion, which was developed by Fornell and Larcker in 1981. The square root of the AVE for each construct should be bigger than the correlations between that construct and other constructs in the model, according to this criterion (see **Table 2** for details).

Table 2. Discriminant Validity (Fornell-Larker-1981 Criteria)

Construct	EC	ICTS	TIWB	TOC	TR	VI	VTLE
EC	0.862						
ICTS	0.844	0.787					
TIWB	0.826	0.766	0.869				
TOC	0.699	0.676	0.715	0.852			
TR	0.702	0.632	0.746	0.742	0.866		
VI	0.720	0.709	0.788	0.772	0.865	0.860	
VTLE	0.834	0.760	0.857	0.657	0.737	0.765	0.850

Note: TOC = Teacher Organizational Commitment, VTLE = Virtual Teaching-Learning Environments, TIWB = Teachers' Innovative Work Behavior, ICTS = ICT Skills, EC = Employee Creativity, VI = Virtual Integration, TR = Technological Readiness.

In order to validate each construct's distinct contribution, this condition ensures that the shared variation between them is lower than their individual variances. Furthermore, the Heterotrait-Monotrait (HTMT) correlation ratio is a relatively modern method for assessing discriminant validity. The HTMT has a criterion

value of 0.85, and values below this criterion indicate discriminant validity (see **Table 3** for details).

Table 3. Discriminant Validity (HTMT)

Construct	EC	ICTS	TIWB	TOC	TR	VI	VTLE
EC							
ICTS	0.828						
TIWB	0.836	0.852					
TOC	0.762	0.734	0.796				
TR	0.768	0.688	0.843	0.810			
VI	0.802	0.787	0.703	0.852	0.866		
VTLE	0.712	0.820	0.860	0.708	0.805	0.846	

Note: TOC = Teacher Organizational Commitment, VTLE = Virtual Teaching-Learning Environments, TIWB = Teachers' Innovative Work Behavior, ICTS = ICT Skills, EC = Employee Creativity, VI = Virtual Integration, TR = Technological Readiness.

Hypotheses Testing

The empirical investigation for this work was conducted with 5000 bootstrap samples using the bootstrap method. (Hair Jr, Hult, Ringle, & Sarstedt, 2016; Hair Jr, Sarstedt, Hopkins, & Kuppelwieser, 2014). **Table 4** shows the hypotheses testing results, which offer insight into the links between the numerous latent constructs in the research framework. Starting with Hypothesis H1, which suggests a positive association between Teacher Organizational Commitment (TOC) and Teachers' Innovative Work Behavior (TIWB), the coefficient (Beta) of 0.210 denotes that a one-unit rise in TOC results in a 0.210-unit increase in TIWB. This link is statistically significant, as indicated by the t-value of 4.400 and the p-value of 0.000. Hypothesis H1 is supported because the p-value is under the usual cutoff of 0.05. Moving on to Hypothesis H2, which claims a positive link between VTLE and TIWB, the coefficient of 0.555 implies that a one-unit rise in VTLE results in a 0.555 unit increase in TIWB. The statistical significance of this association is indicated by the matching t-value of 11.481 and the p-value of 0.000. Hypothesis H2 is supported since the p-value is significant. Continuing with Hypothesis H3, the coefficient of 0.608 indicates that a one-unit rise in TIWB correlates to a 0.608 unit increase in ICTS. The statistical significance of this link is shown by the t-value of 12.270 and the p-value of 0.000. Hypothesis H3 is supported by the significance of the p-value. With regard to Hypothesis H4, which proposes a positive correlation between TIWB and employee Creativity (EC), the coefficient of 0.667 shows that a one-unit increase in TIWB results in a 0.667-unit rise in EC. This link is statistically significant, according to the t-value of 16.632 and the p-value of 0.000. Hypothesis H4 is supported because the p-value is less than the accepted level.

Moderation Analysis

Hypothesis H5 suggested that Virtual Integration (VI) has a moderating effect on the relationship between Teacher Organizational Commitment (TOC) and Teachers' Innovative Work Behavior (TIWB), the coefficient (Beta) of 0.081 indicates that an increase in the interaction between VI and TOC results in an increase in TIWB of 0.081 units. This moderating effect is statistically significant, as shown by the t-value of 2.364 and the p-value of 0.009. Hypothesis H5 is supported. Moving on to Hypothesis H6, which investigates the moderation effect of VI on the relationship between Virtual Teaching-Learning environments (VTLE) and TIWB, a coefficient of 0.086 indicates that a unit increase in the interaction between VI and VTLE corresponds to a 0.086 unit rise in TIWB. The statistical significance of this moderation effect is confirmed by a t-value of 2.525 and a p-value of 0.006. Hence H6 is supported. With regard to Hypothesis H7, which argues that Technological Readiness (TR) has a moderating effect on the link between TIWB and ICT Skills (ICTS), the coefficient of 0.129 indicates that a unit increase in the interaction between TR and TIWB results in a 0.129 unit increase in ICTS. This moderating effect is statistically significant, as shown by the t-value of 5.606 and the p-value of 0.000. Therefore, H7 is accepted. The value of 0.034 indicates that a unit increase in the interaction between TR and TIWB corresponds to a 0.034 unit increase in EC. The statistical significance of this moderating effect is shown by the t-value of 1.675 and the p-value of 0.047. Hence, Hypothesis H8 is supported (**Figure 3**).

Table 4. Hypotheses Testing

	Hypotheses	Coefficient (Beta)	SD	*T*	*P*	Status
H1	TOC -> TIWB	0.210	0.048	4.400	0.000	Supported
H2	VTLE -> TIWB	0.555	0.048	11.481	0.000	Supported
H3	TIWB -> ICTS	0.608	0.050	12.270	0.000	Supported
H4	TIWB -> EC	0.667	0.040	16.632	0.000	Supported
	Moderation Hypotheses	**Coefficient (Beta)**	**SD**	***T***	***P***	**Status**
H5	VI x TOC -> TIWB	0.081	0.034	2.364	0.009	Supported
H6	VI x VTLE -> TIWB	0.086	0.034	2.525	0.006	Supported
H7	TR x TIWB -> ICTS	0.129	0.023	5.606	0.000	Supported
H8	TR x TIWB -> EC	0.034	0.020	1.675	0.047	Supported

Note: TOC = Teacher Organizational Commitment, VTLE = Virtual Teaching-Learning Environments, TIWB = Teachers' Innovative Work Behavior, ICTS = ICT Skills, EC = Employee Creativity, VI = Virtual Integration, TR = Technological Readiness.

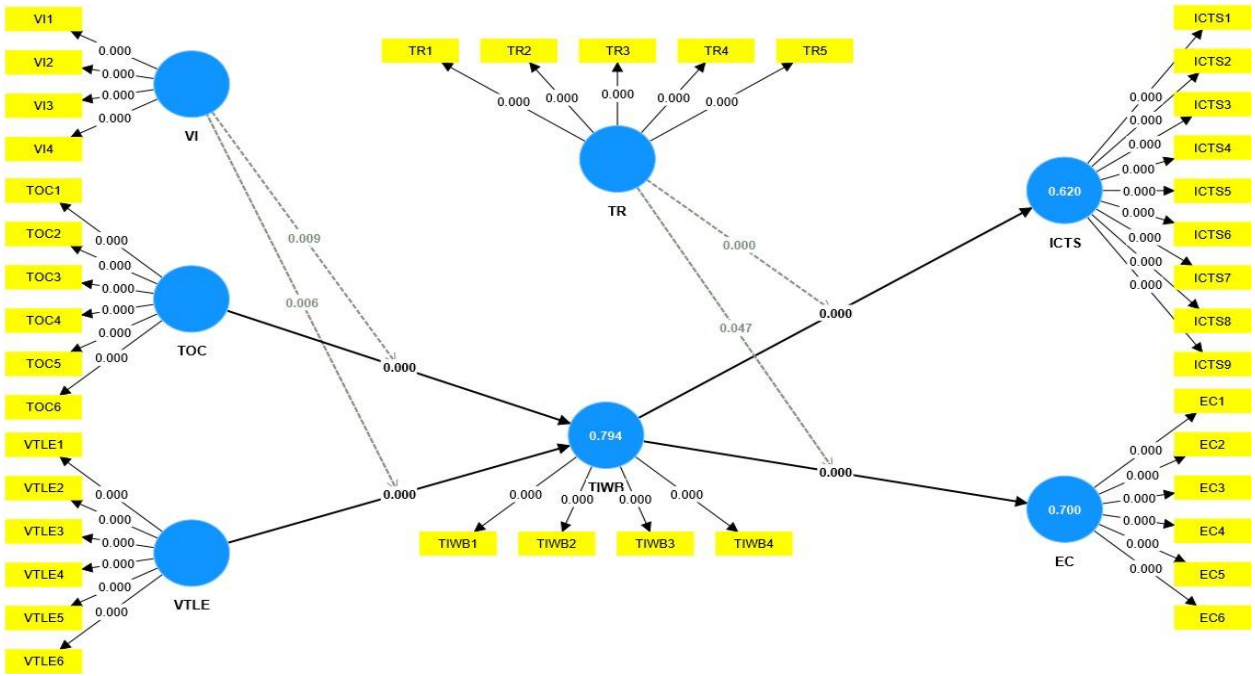

Figure 3. Structural Model

DISCUSSION

The present discovery provides empirical evidence in support of the proposition that there exists a positive relationship between teacher organizational commitment (TOC) and teacher innovative behavior (TIB). The level of teachers' occupational commitment (TOC) indicates how much they identify with and are devoted to their workplace. Teacher Innovative Behavior (TIB) refers to the degree to which educators produce and apply novel ideas aimed at enhancing their instructional methods and promoting student learning outcomes (Donker, van Vemde, Hessen, van Gog, & Mainhard, 2021). As a result of their higher levels of enthusiasm, participation, and loyalty to their jobs, this research shows that instructors who are more loyal to their organization are more likely to exhibit innovative behaviors (Alt, Kapshuk, & Dekel, 2023). Day's (2023) discovery enhances literature on teacher organizational commitment (TOC) impacting student achievement, retention, and well-being, and

emphasizes its importance in teacher innovative behavior (TIB) in responding to evolving education demands.

This result lends credence to the idea that virtual teaching-learning environments (VTLE) have a beneficial impact on TIB. The use of digital tools and platforms to speed up and improve the educational process is known as VTLE (C. A. Garcia, Caiza, Naranjo, Ortiz, & M. Garcia, 2019). Increased access, flexibility, interaction, cooperation, and personalization are some of the advantages of VTLE. This research implies that since more opportunities, resources, and support are available to instructors who utilize VTLE more frequently and successfully, they are more likely to engage in innovative behaviors (Flórez-Aristizábal, Cano, Collazos, Solano, & Brewster, 2019). This discovery adds to the body of knowledge on VTLE by demonstrating that TIB, which is crucial for fostering teachers' creativity and innovation, is supported by VTLE in addition to supporting instructors' pedagogical practices, student learning, and professional development.

This result lends credence to the idea that TIB enhances ICT competencies. The ability to efficiently and creatively use information and communication technology (ICT) in a variety of circumstances is known as an ICT talent (Váradi, Józsa, Fodor, Molnár-Tamus, & Szűcs, 2023). Teachers must have ICT skills in order to improve their educational approaches, increase student learning, and participate in professional development opportunities. As a result of having more opportunities and a desire to use ICT in their work, this data shows that instructors who exhibit more innovative behaviors also tend to have greater ICT abilities (B. A. Çallı & L. Çallı, 2021). This finding matches with prior research that indicated a positive connection between TIB and ICT capabilities. This discovery provides the body of knowledge on TIB through demonstrating that ICT proficiency, which is essential for competence and performance in the digital age, is also impacted through TIB, further to instructors' creativity and innovation.

This result is consistent with the idea that TIB fosters employee creativity. For an organization to function well, to be competitive, and to innovate, its employees must be creative (Javed et al., 2021). This finding implies that instructors who participate in more innovative behaviors have higher levels of creativity in their work domains because they have more cognitive processes, resources, and support for their creative activities. This result is in line with other research that discovered a beneficial connection between TIB and staff members' creativity (Amedome, 2023). TIB has been shown to negatively affect employee creativity.

The present discovery provides empirical evidence in support of the proposition that virtual integration (VI) acts as a moderator in the association between teacher organizational commitment (TOC) and turnover intention behavior (TIB). The variable of interest (VI) pertains to the extent to which educators employ digital technologies and platforms in order to engage in communication, collaboration, and coordination with their peers, students, and other relevant individuals (Aguilar et al., 2021). VI can offer a number of advantages, including improved accessibility, adaptability, interactivity, diversity, and efficiency. Virtual interaction (VI) has the capability to enhance the effectiveness of teamwork and collaboration by enabling the sharing of statistics, offering social help, facilitating feedback, and fostering innovation (Qiao, Xu, Li, & Ouyang, 2021). Particularly, instructors with excessive VI had a greater favorable effect from TOC on TIB than teachers with low VI. This discovery aligns with earlier research that has identified a moderating influence of VI on the affiliation between TOC and TIB (Al-shami, Al mamun, Rashid, & Cheong, 2023). This discovery further enhances the existing body of work on VI by way of demonstrating that VI has an effect now not only most effective on the adoption and usage of technology, but also on the TIB via its interaction with the TOC.

This result lends credence to the idea that VI modifies the connection between VTLE and TIB. Increased accessibility, flexibility, interactivity, collaboration, and personalization are just a few advantages that VTLE may offer. By offering chances, materials, and support for instructors' instructional activities, VTLE can also aid TIB (Albrecht & Raymond, 2021). This result implies that the level of VI affects how VTLE affects TIB. In particular, instructors with high VI scores benefited more from VTLE than teachers with low VI scores in terms of TIB (Bauce, Kaylor, Staysniak, & Etcher, 2023). This result is in line with other research that discovered a moderating role for VI in the interaction between VTLE and TIB.

This result confirms the theory that the association between TIB and ICT skills is moderated by technological readiness (TR), which is a related concept. TR is a measure of how ready and able teachers are to adapt and use new technology in their classrooms (Brozzi, Riedl, & Matta, 2021). TR is affected by a number of variables, including individual traits, attitudes, beliefs, knowledge, abilities, and resources. Increased motivation, competence, contentment, and confidence are just a few advantages that TR can offer (Dinh, Le, Duong, & Pham, 2023). TR can help people accept, use, and adapt technology, which helps TIB and ICT abilities. This result implies that the level of TR affects how TIB affects ICT abilities. In particular, instructors with high TR had a higher favorable impact from TIB on their ICT talents than teachers with low TR (Jafari-Sadeghi, Garcia-Perez, Candelo, Couturier, 2021). This result is in line with earlier research that discovered a moderating role for TR in the hyperlink between TIB and ICT abilities. This discovery provides to the body of knowledge on TR by

demonstrating how TR interacts with TIB to alter ICT talents similarly to technology acceptance and use.

This result lends credence to the idea that TR moderates the association between TIB and employee inventiveness. employee creativity is the capacity to develop unique and practical concepts or solutions across a range of fields. Innovation, competitiveness, and organizational effectiveness all depend on employee creativity (Fořtová, Sedláčková, & Tůma, 2021). This result implies that the degree of TR affects how negatively TIB affects an employee's creativity. In specific, teachers with excessive TR had a higher favorable effect from TIB on employee creativity than teachers with low TR (Peñarroya-Farell, Miralles, & Vaziri, 2023). This result is in line with other research that discovered a moderating role for TR in the association between TIB and employee creativity. This discovery adds to the frame of knowledge on TR by way of demonstrating how TR interacts with TIB to influence employee creativity further to technology acceptance and utilization.

CONCLUSION

In the rapidly changing educational landscape, this study illuminates the complex interplay between teacher organizational commitment, virtual teaching-learning settings, innovative work behavior, ICT abilities, and employee creativity. The findings provide insightful information on how these linked elements interact with one another in educational settings. Understanding the mechanisms that motivate creativity among educators has been made possible by the study's examination of the connections between teacher organizational commitment and innovative work behavior as well as the effect of virtual teaching-learning environments on these variables. The complexity of these linkages is shown by the involvement of ICT skills as a potential mediator between commitment and innovative behavior as well as the beneficial effects of innovative workplace behavior on employee creativity. The study's emphasis on the moderating effects of virtual integration and technological preparation highlights the significance of a well-balanced technological integration and the readiness of teachers to make use of technology's potential for innovation. These observations offer insightful advice for educational institutions looking to create an atmosphere that encourages dedication and innovation within their teaching personnel. In summarizing this study, it is clear that this research has skillfully braided together the complex web of relationships that support creative work behavior and creativity among educators within the modern educational landscape. This study extends the conversation in educational psychology and pedagogy by bringing teacher organizational commitment, virtual teaching-learning settings, ICT abilities, and technological readiness to the forefront.

IMPLICATIONS

The present study holds significance for both the theoretical and practical aspects within the realm of education and innovation. This study aims to enhance the existing body of knowledge on teacher's innovative work behavior (TIB) by examining the impact of various contextual factors, including teacher organizational commitment (TOC), virtual teaching-learning environment (VTLE), and technological readiness (TR), on the relationship between TIB and employee creativity. Prior research has predominantly concentrated on examining individual or organizational factors, such as personality traits, motivation, leadership, or culture, in the context of their role as moderators or mediators in this association. This study expands upon previous research by emphasizing the significance of technology in moderating and mediating the aforementioned relationship. This study further enhances the existing body of literature on employee creativity by demonstrating the impact of TIB on employee creativity across multiple domains. Prior research has predominantly concentrated on the examination of employee creativity within distinct fields, such as science, engineering, or arts. This study expands the scope by demonstrating that TIB has a universal impact on employees' creativity, irrespective of the specific field.

Practically, this study holds significance for educators and managers seeking to cultivate employee creativity inside their respective enterprises. This study posits that the augmentation of teachers' levels of teacher organizational commitment (TOC), teacher value in teaching and learning effectiveness (VTLE), and teacher resilience (TR) can lead to an increase in their teacher innovation behavior (TIB) and foster greater employee creativity. Hence, it is imperative for educators and managers to offer comprehensive training, ongoing support, and appropriate incentives to facilitate the cultivation of teachers' Technological Pedagogical Content Knowledge, Virtual Teaching and Learning environments, and Technological Readiness. This will enable instructors to effectively embrace and integrate emerging technologies into their instructional practices. Furthermore, it is

imperative for educators and managers to actively promote and incentivize the practice of Innovative behavior among teachers, as it has the potential to foster enhanced levels of creativity within their respective professional spheres. This study also holds significance for policymakers and stakeholders seeking to foster innovation and enhance competitiveness within society. This has a look at posits that transformational leadership and employee creativity play crucial roles in enhancing organizational performance, competitiveness, and innovation. Hence, it is imperative for policymakers and relevant stakeholders to establish a favorable setting that fosters both innovation behavior and staff creativity. This can be achieved through the provision of sufficient resources, acknowledgment, and support to encourage innovative behaviors. Furthermore, it is imperative to provide backing for the dissemination and integration of novel technologies within the realm of education as well as other industries.

LIMITATIONS AND FUTURE DIRECTIONS

Limitations: To provide a complete picture of the study's scope and ramifications, it's far essential to note giant obstacles despite the insightful conclusions reached. First off, the sample size used in this study takes a look at most effective included teachers from a limited number of educational institutions, which may additionally have limited the findings' applicability to a wider range of educational settings. The observation of findings' applicability to other conditions might also be constrained with the aid of the distinctive qualities of these institutions and their instructors. Second, the study's move-sectional method has inherent drawbacks despite being excellent for supplying a snapshot of interactions. It makes it impossible to build causal connections and observe changes and developments through time. In order to explore the temporal dynamics of the variables under have a look at, a longitudinal strategy would be more appropriate.

Furthermore, the use of self-reported measures to collect data involves inherent biases that can affect the validity of the results. Due to social desirability, respondents may have response biases that cause them to overestimate or underestimate particular constructs. Additionally, the study's emphasis on particular constructs, such as teacher organizational commitment, virtual teaching-learning environments, teachers' innovative work behavior, ICT skills, and employee creativity, may have unintentionally ignored the potential impact of other pertinent variables that could have contributed to the relationships seen.

Future Directions: From these restrictions, a research agenda for the future is formed. A more thorough understanding would result from longitudinal studies that chart the development of teachers' commitment to their jobs, their use of innovation, and their interactions with technology over time. A stronger foundation for determining causal linkages would be provided by experimental methods that manipulate variables like virtual integration or technical preparedness. An improved understanding of teachers' perspectives might result from a mixed-methods approach that combines quantitative analysis with qualitative insights. Variations in the correlations under investigation would be made clear by comparative analysis across various educational levels and cultural situations. Another intriguing approach is to use mediation analyses to investigate potential mediating factors and the underlying mechanisms between the constructs being studied. It would be beneficial for educational institutions to learn more about how certain training programs might improve technology preparedness and, in turn, enhance creative problem-solving and innovative work practices. Our understanding of the complex interactions between teacher organizational commitment, virtual teaching-learning settings, innovative work behavior, ICT abilities, and employee creativity in educational contexts would improve if we adopted these future study topics.

CONFLICT OF INTEREST

No potential conflict of interest was reported by the author.

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