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Technology development, innovation practice and professional development among college teachers in China: Basis for developing a community of practice framework

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Abstract

The goal of the study is to do an in-depth research of technology development, innovation practice and professional development among colleges in China and develop a community of practice framework to ensure such colleges keep tapping their development potential and enhance student performance. This study uses descriptive research design for an adequate and precise interpretation of the findings. The respondents of the study were the teachers at Henan University of Urban Construction, Hubei University of Automotive Technology, Zhongshan Torch Polytechnic, Fujian Forestry Vocational and Technical College, Pingdingshan Polytechnic College. A total of 402 teachers participated in the survey, the researchers used survey questionnaire as the main instrument to obtain real first-hand data. The study used a variety of statistical tools to analyze the data, including frequency count, weighted means, and ranking to assess technology development, innovation practice and professional development among colleges. The study found that the relationship between technology development and education development is intricate and dynamic, technology and education are intertwined in a symbiotic relationship. Technology has the potential to enhance the quality, accessibility, and effectiveness of education, over the years, technology has had a profound impact on education, transforming the way we learn, teach, and interact with educational content. The study also revealed innovation and education development is crucial for fostering progress, adaptability, and the advancement of societies. While education development involves the improvement and enhancement of educational systems, approaches, and outcomes. In essence, innovation and education development are intertwined forces that drive each other forward. Innovation enhances education by creating dynamic learning environments, embracing new technologies, and fostering critical thinking skills. At the same time, education development provides a foundation for innovation by equipping individuals with the knowledge, skills, and mindset needed to drive meaningful change in various fields. As well, the study shown profession development equips teachers with the knowledge and skills needed to excel in their chosen professions, while the development of teachers' professions abilities drives changes

and improvements in colleges to ensure that teachers are prepared for the challenges and opportunities of learning and teaching. This relationship underscores the importance of collaboration between colleges, teachers, industries, and policymakers to create well-prepared and adaptable teachers. In summary, the three factors are the super glue to weave teachers, processes, and all other critical educational elements into unique innovation competency, integrate policies, programs, and structures for managing a comprehensive and all-round development portfolio, scale up community practices, amplify instructional effect, set up the collaboration platform and glue up a framework which enables the institution to manage colleges in a structural way.

Keywords: technology development, innovation practice, professional development, community of practice framework

Technology development, innovation practice and professional development among college teachers in China: Basis for developing a community of practice framework

1. Introduction

The rapid development of technology has profoundly changed the landscape of higher education. Higher education teachers, once largely limited to traditional teaching methods, are now increasingly required to integrate technology into their teaching practices. This change requires a deep understanding of technological developments, innovative teaching methods, and continuous professional development. Communities of Practice (CoPs) serve as valuable frameworks for promoting collaboration, knowledge sharing, and continuous learning among teachers. By creating a supportive environment where teachers can connect, discuss challenges, and explore new technologies, CoPs can significantly improve the quality of teaching and learning. This study aims to investigate the relationship between technological developments, innovative practices and professional development of university teachers. The aim is to identify key factors influencing the effective adoption and use of technology in the classroom and to develop a strong community of practice framework that can support teachers in their innovation and professional development.

Technology development in higher education refers to the creation, adoption and integration of technological tools and resources to improve teaching, learning and research. It covers a wide range of innovations, from traditional software and hardware to emerging technologies such as artificial intelligence, virtual reality and augmented reality. Major areas of technology development in higher education include learning management systems (LMS), educational technology (EdTech), digital libraries and information resources, virtual and augmented reality, online courses and massive open online courses (National Center for Education Statistics, 2018). Interestingly, Allen et al. (2018) revealed that technology development has had a profound impact on higher education, bringing many benefits such as increasing access to education, enhancing the learning experience, increasing efficiency and productivity, and facilitating collaboration. However, effectively integrating technology in higher education also poses challenges, including the digital divide, privacy and security concerns, and professional development for teachers.

Addressing these challenges requires a comprehensive approach that includes institutional leadership and support, faculty development and training, student support, collaboration, and partnerships. By addressing these challenges and leveraging the opportunities presented by technological developments, higher education institutions can create more equitable, engaging, and effective learning environments for students. Technology developments in higher education are an important area with the potential to transform teaching and learning. By understanding the benefits and challenges associated with integrating technology and implementing effective strategies to address these challenges, higher education institutions can create more innovative and equitable learning environments for all students. Innovative practices in higher education refer to the systematic application of new ideas, methods or technologies to improve teaching, learning and research outcomes. They imply a culture of experimentation, risk-taking and continuous improvement. Key features of innovative practices include problem solving, experimentation, collaboration and continuous learning (Aydin et al., 2023). Innovative practices are essential for higher education institutions to remain competitive and relevant in a rapidly changing educational landscape. According to Boer et al. (2020), by fostering a culture of innovation, institutions can improve student outcomes, increase faculty satisfaction, and drive institutional progress. However, implementing innovative practices can be difficult and requires institutional leadership, faculty support, and adequate resources.

Professional development for college teachers refers to the process of continuously learning and improving their skills, knowledge, and teaching practices. It is important for educators to stay up to date on the latest teaching methods, technological advances, and research findings in their field (Pritchard et al., 2019). Key

elements of professional development include continuing education, mentoring, collaboration, reflection, and research. Moreover, professional development is essential for college teachers to improve their teaching effectiveness, maintain relevance, promote student success, and advance their careers. By participating in professional development activities, teachers can learn new skills, improve their teaching methods, and provide students with a high-quality education (OECD, 2022). To promote the professional development of university faculty, institutions usually provide adequate funding and support for professional development activities. In addition, higher education institutions create a culture that values lifelong learning and encourages collaboration among faculty. By investing in professional development, HEIs improve the quality of teaching and learning and enhance the overall effectiveness of faculty.

One of the key challenges in studying technology development, innovative practices, and professional development of university teachers is the difficulty in defining and measuring these key concepts. Technology development in higher education encompasses a wide range of tools and applications, from traditional software and hardware to emerging technologies such as artificial intelligence, virtual reality, and augmented reality. Defining what constitutes "technology" in this context can be complex because the lines between technology and traditional teaching methods are often blurred. Additionally, measuring the extent of technological development in different institutions can be difficult because it can vary depending on factors such as institutional size, resources, and cultural context.

Innovative practices in education are another concept that is difficult to define and measure. While innovation often involves the introduction of new ideas, methods, or technologies, the definition of what constitutes an "innovative" practice can be subjective and varies across contexts. Measuring the impact of innovative practices on student learning and outcomes can also be difficult because it requires careful consideration of various factors such as student engagement, motivation, and learning outcomes. Professional development for university teachers is a complex process that includes a variety of activities, from attending conferences and workshops to participating in mentoring and self-reflection programs. Quantifying the quality and effectiveness of professional development programs can be difficult because it can depend on factors such as program content, participant experiences, and long-term impact on teaching practice. Understanding the relationship between these three areas can contribute to expanding knowledge about higher education and teaching practices. Identifying effective strategies for integrating technology, innovation, and professional development can inform policy decisions and institutional practices. Additionally, the study can help identify and address challenges that higher education educators face in adopting new technologies and innovative approaches.

This study can inform effective professional development strategies and help teachers advance their profession. By understanding the benefits of integrating technology and innovation, teachers can improve their teaching practices and enhance student learning. Additionally, increased confidence in the ability to use technology effectively can improve teacher morale and job satisfaction. This research can inform institutional policies and practices related to technology investments, faculty development, and pedagogical innovation. By supporting faculty professional development and technology adoption, higher education institutions can improve student experiences and learning outcomes. Additionally, institutions that prioritize innovation and professional development can enhance their reputations and attract top faculty and students.

Objectives of the Study - The study aimed to examine the technology development, innovation practice and professional development among College Teachers in China that was made the basis in developing a Community of Practice Framework. Specifically, it described the technology development in terms of technology knowledge, technology skills and technology disposition; determined the innovation practices as to culture of innovation, personalized learning and using data to inform instruction; assessed the professional development in terms of service to profession, digital literacy and lifelong learning; tested the significant relationship among technology development, innovation practice and professional development and developed a community of practice framework for college teachers.

2. Methods

Research Design - Descriptive research plays an important role in understanding technological developments, innovative practices, and professional development of university teachers. This method focuses on describing existing phenomena without modifying variables. Its use in this context has several benefits: When exploring new trends in technology integration or professional development, descriptive design allows researchers to collect initial data and identify key themes or patterns. This helps paint a picture of the current situation – how teachers are using technology, what innovative practices exist, and how professional development is currently delivered. By documenting current practices, researchers gain valuable insights into the challenges, successes, and factors influencing technology adoption and innovation. This understanding serves as a basis for future research, providing a benchmark for measuring progress and identifying areas for improvement. In addition, descriptive studies can help refine future research directions. The results can reveal specific research questions and generate hypotheses for further research. This focused approach ultimately leads to a deeper understanding of the factors influencing technology and innovation in Chinese higher education.

Participants of the Study - The respondents of the study were the 402 teachers in five universities and colleges in China. The researcher believes that teachers are the key to educational innovation, and that by understanding their needs and challenges, they can develop more effective strategies for supporting them. Higher education teachers are key actors and stakeholders in the educational process, making them the most suitable subjects for research on technological developments, innovation practices and professional development. Their direct involvement in the use of technology, implementation of innovative methods and participation in professional development activities provide valuable insights into the challenges, opportunities and effectiveness of these initiatives. Teachers have a deep understanding of the specific context of higher education in China, including the institutional, cultural and social factors that influence technology adoption and innovation. Their perspectives help researchers interpret the results in a relevant and meaningful framework. In addition, teachers' experiences can be useful in the development of policies and strategies to promote technological developments, innovation and professional development. Teachers are key members of communities of practice where they can collaborate, share knowledge, and learn from each other. Their participation in these communities is essential to fostering a culture of innovation and continuous professional development. By focusing on teachers as respondents, the study can gain a rich and nuanced understanding of the factors influencing technological developments, innovation practices, and professional development in higher education in China, ultimately leading to the development of a more effective framework for fostering communities of practice. Purposive convenience sampling was used because of its practical advantages. Universities and colleges are relatively accessible, making it convenient for researchers to recruit participants. This approach can also save time and resources compared to other sampling methods. Additionally, research focusing on technological developments, innovative practices, and professional development of university teachers suggests that universities and colleges may have relevant experience and expertise to contribute to the study.

Instrument of the Study - The survey questionnaire was used as the data gathering instrument in the present study. The questionnaire was self-constructed based on the literature read in published research. Self-made questionnaires are a popular tool because of their flexibility and control. The researcher was able to tailor questionnaires to their specific research objectives, ensuring that questions are relevant and informative. This approach also allows for complete control over question wording, format, and sequencing, improving the clarity and efficiency of data collection. Additionally, self-made questionnaires can be designed to meet the unique needs and challenges of research, such as exploring specific aspects of technological developments, innovation practices, and professional development of college teachers. By using self-developed questionnaires, the researcher was ensured that the data collected is relevant to their research objectives and provides the specific information needed to answer the research questions. The survey has three parts. The first part assessed the technology development in terms of technology knowledge, technology skills and technology disposition. The second part assessed the innovation practices as to culture of innovation, personalized learning and using data to

inform instruction. The third part assessed professional development in terms of service to profession, digital literacy and lifelong learning.

The four-point Likert scale was used with four options, ranging from strongly disagree to strongly agree. The higher the score, the higher the agreement, and the lower the score, the lower the agreement: "4" means strongly agree (SA), "3" means agree (A); "2" means disagree (d); "1" means strongly disagree (SD). This study adopted Cronbach's alpha analysis test, which is a commonly used statistical method to evaluate the internal consistency and reliability of questionnaires or tests. It measures the consistency between the items in the questionnaire, that is, whether all the items are measuring the same concept. The higher the Cronbach's alpha value, the better the internal consistency of the questionnaire. Generally, Cronbach's alpha values above 0.7 are considered acceptable, and above 0.8 are considered good.

Table 1
Reliability Summary Table – Technology Development, Innovation Practice and Professional Development Instrument

Indicators	Cronbach Alpha	Remarks
Technology Development, Innovation Practice and Professional Development Instrument	.958	Excellent
Per variable		
Technology Development	.873	Good
Technological knowledge	.725	Acceptable
Technology skills	.781	Acceptable
Technology dispositions	.738	Acceptable
Innovation Practice	.923	Excellent
Culture of Innovation	.847	Good
Personalized Learning	.875	Good
Using data to inform instruction	.891	Good
Professional Development	.838	Good
Service to Profession	.719	Acceptable
Digital Literacy	.712	Acceptable
Lifelong learning	.860	Good

Data Gathering Procedure - A self-designed online questionnaire was developed to collect data from university teachers. The questionnaire covered topics such as technology integration, innovative teaching practices, and professional development. After a pilot study to refine the questionnaire, it was distributed to university teachers from five universities and colleges selected through purposive convenience sampling. The collected data was entered into spreadsheets or statistical software for analysis. Results were presented in a clear and concise manner, with tables and other visuals to illustrate key findings. The implications of the findings were discussed in relation to existing literature and theoretical frameworks. Based on the findings, recommendations were made to promote technological development, innovative practices, and professional development of college teachers in China. Ethical approval was obtained from the Ethics Committee of the university to ensure that the research is conducted ethically and respects the rights of participants. Informed consent was obtained from participants prior to their participation in the study, and their confidentiality was ensured with anonymous identifiers.

Data Analysis - Weighted mean and rank were used to describe technology development in terms of technology knowledge, technology skills and technology disposition; determine the innovation practices as to culture of innovation, personalized learning and using data to inform instruction; assess the professional development in terms of service to profession, digital literacy and lifelong learning. The result of Shapiro-Wilk Test showed that p-values of all variables were less than 0.05 which means that the data set was not normally distributed. Therefore, Spearman rho was used as part of the non-parametric tests to determine the significant relationship. All analyses were performed using SPSS version 28.

Ethical Consideration - Ethical considerations are an important factor. In addition to normal ethical standards, the investigators paid special attention to the following points when conducting the survey. Respect research participants, ensure the privacy and anonymity of all participants, obtain informed consent, and ensure

that participants understand the purpose, process and potential risks of the research, including data security and privacy protection. When collecting, organizing and using data, the researcher ensured the legality and ethics of data collection methods, and avoided using data that may violate privacy or cause harm to participants when using evaluation technology tools and methods. When using evaluation technology tools and methods, they also avoid ensuring legality and ethics. To ensure the objectivity and fairness of the research purpose, methods and expected results, the researcher ensured the transparency of the research design and implementation process and ensured that there is no bias and discrimination in the investigation and research process to ensure the fairness and objectivity of the research results. Intellectual property and copyright were also key considerations. Researchers respect the intellectual property and copyright of others, and correctly cite and attribute the work of others. Because it involves the professional development of teachers, researchers especially consider ethical issues in the process of teacher development, such as the fairness of career promotion, and the equality of teacher training and professional development opportunities. Moreover, it considers the impact of research on society, both in the long and short term, and ensures that the research makes a positive contribution to the field of education. During the investigation process, the researcher first identifies and resolves possible conflicts of interest to ensure that the research is independent and objective. Finally, in terms of the dissemination of research results, the researcher ensures that the dissemination of research results is responsible while avoiding exaggerated or misleading reporting of research results. Constructing such an ethical consideration framework helps ensure that the research is ethical and responsible, while also protecting the interests of research participants, researchers, and the entire academic community.

3. Results and discussion

Table 2
Summary Table on Technology Development

Key Result Areas	Composite Mean	VI	Rank
Technology Knowledge	3.55	Strongly Agree	2
Technology Skills	3.54	Strongly Agree	3
Technology Disposition	3.56	Strongly Agree	1
Grand Composite Mean	3.55	Strongly Agree	

Legend:3.50-4.00=Strongly Agree;2.50-3.49=Agree;1.50-2.49=Disagree;1.00-1.49=Strongly Disagree

Table 2 summarizes the technology development as to technology knowledge, technology skills and technology disposition with a grand composite mean of 3.55. This indicates that respondents strongly agreed that they positively regard technology development in their profession. This value reflects the confidence and ability of educators in the field of technology as well as their positive attitude towards the application of technology in education.

The highest-scoring indicator analysis is "Technology Disposition", with a weighted mean of 3.56, corresponding to "Strongly Agree". The highest score on this indicator may be because educators recognize that having an open mind and innovative thinking is essential to adapt to the rapidly changing technological environment. Teachers with positive technology attitudes are more likely to actively adopt new technologies, are willing to try new technologies, and adapt to changes in teaching practices to promote innovation in teaching methods and enrich learning experiences. Attitudes toward technology, characterized by openness to innovation, belief in the potential of technology, a growth mindset, and a commitment to professional development, are important factors in effective technology integration among secondary school teachers. According to Chen et al. (2021), teachers with positive attitudes toward technology are more likely to embrace new technologies, see their value in improving teaching and learning, and actively seek opportunities to improve their skills. These factors contribute to more successful and effective use of technology in the classroom.

“Technology Knowledge" and "Technology Skills" ranked second and third with weighted averages of 3.55 and 3.54, respectively. The rankings of these two areas are close, indicating that teachers also have high evaluations in terms of technological knowledge and skills. The lowest-scoring indicator is "Technology Knowledge", with a weighted average of 3.55. Although it also belongs to the "Strongly Agree" range, it is

slightly lower than other indicators. This may be because technology knowledge requires continuous learning and updating, and some educators may feel challenged in keeping up with the latest technological developments. Teachers may need more training and practical opportunities to improve their application capabilities.

Table 3

Summary Table on Innovation Practices

Key Result Areas	Composite Mean	VI	Rank
Culture of Innovation	3.54	Strongly Agree	2
Personalized Learning	3.55	Strongly Agree	1
Using Data to Inform Instruction	3.52	Strongly Agree	3
Grand Composite Mean	3.54	Strongly Agree	

Legend:3.50-4.00=Strongly Agree;2.50-3.49=Agree;1.50-2.49=Disagree;1.00-1.49=Strongly Disagree

Table 3 summarizes the innovation practices with a composite mean of 3.54. This indicates that in each key result area of innovation practice, this high consistency may indicate the widespread recognition and support of innovation practices in the educational environment, which is essential for promoting continuous improvement and innovation in the field of education. The grand overall grand composite mean is 3.54, indicating that the respondents generally have a positive attitude towards these practices. This summary table provides a comprehensive assessment of educational innovation practices and is of great significance for understanding innovation trends and priorities in the field of education.

The highest-scoring indicator analysis, personalized learning, has a weighted average of 3.55. The reason why personalized learning scored the highest may be that it directly responds to the needs of individual differences of students and can better meet the learning styles and ability levels of different students. This educational method can improve student engagement and learning outcomes, thus gaining high recognition from educators and students. Personalized Learning ranked first with a composite mean of 3.55 and a VI of "Strongly Agree". This shows that personalized learning is highly valued in educational innovation practices. Personalized learning pays attention to individual differences among students and can improve learning outcomes and student engagement.

The indicators of intermediate indicators 2-3 and their weighted averages and textual explanations were analyzed. Culture of Innovation ranked second with a comprehensive average of 3.54 and a VI of "Strongly Agree". This reflects that educators recognize the importance of innovative culture in promoting educational progress. A positive innovative culture can encourage teachers and students to try new methods and learn from failures. Using Data to Inform Instruction ranked third with a comprehensive average of 3.52 and a VI of "Strongly Agree", showing the important role of data in educational decision-making.

The lowest-scoring indicator analysis, Using Data to Inform Instruction, has a weighted average of 3.52. Although this data has the lowest score in the comprehensive average, it does not mean that it is not effective in actual application. Instead, it may reflect the challenges faced by educators in data interpretation and application. Data-driven teaching requires a high degree of professional skills and understanding of data science, which may be lacking in some educators. Among these innovative practices, personalized learning and cultural innovation are two closely related dimensions. A culture that supports innovation can promote the implementation and development of personalized learning strategies. In addition, using data to guide teaching is a key tool for achieving personalized learning, which helps teachers adjust teaching methods according to the specific needs of students.

Table 4

Summary Table on Professional Development

Key Result Areas	Composite Mean	VI	Rank
Service to Profession	3.53	Strongly Agree	2.5
Digital Literacy	3.53	Strongly Agree	2.5
Lifelong Learning	3.56	Strongly Agree	1
Grand Composite Mean	3.54	Strongly Agree	

Legend:3.50-4.00=Strongly Agree;2.50-3.49=Agree;1.50-2.49=Disagree;1.00-1.49=Strongly Disagree

Table 4 summarizes the professional development of college teachers indicating a grand composite mean of 3.54. The composite mean shows that college teachers generally hold a positive attitude towards professional development and believe that professional development is essential to improving service quality, digital literacy and lifelong learning. This reflects an overall satisfaction of respondents with the key result area of professional development. This value is in the "Strongly Agree" range, indicating that respondents generally have a positive attitude towards professional development. This shows that college teachers recognize that continuous professional development is the key to improving teaching quality and adapting to educational changes.

Lifelong Learning with a weighted average of 3.56 got the highest score for professional development. This may be because educators realize that in a rapidly changing educational environment, continuous learning and self-improvement are the key to keeping teaching methods modern and effective. Educators may believe that through lifelong learning, they can better adapt to the development of educational technology and meet the diverse needs of students. The European Commission/EACEA/Eurydice report provides a comprehensive perspective on teachers' CPD, emphasizing the importance of lifelong learning.

Next, the indicators of "Service to Profession" and "Digital Literacy", which both tied for second place with a composite mean of 3.53. The high ratings in these two areas reflect the emphasis on professional service and digital skills in professional development. However, the lowest weighted average in the table, "Service to Profession", is ranked second. The profession ranked last with a ranking of 2.5. This may be related to the gap between respondents' expectations of professional services and their actual participation. According to Lee (2019), participation in professional services is affected by a variety of factors, including time constraints, resource availability, and personal motivation. In addition, the rewards of professional services may not be as direct or obvious as other professional development activities, which may lead to lower evaluations (Wang et al., 2022).

Table 5 demonstrates the relationship between technology development and innovation practices. As seen in the table, computed rho-values ranging from 0.823 to 0.906 indicate a very strong direct relationship among the sub variables of technology development and innovation practices. There was a statistically significant relationship between technology development and innovation practices because the obtained p-values were less than 0.05. The significance of these correlation coefficients shows that the support of technology development plays a key role in promoting innovative educational practices, and emphasizes the key role of innovation culture, personalized learning, and the use of data to guide teaching in cultivating the technical capabilities of college teachers.

Table 5
Relationship Between Technology Development and Innovation Practices

Variables	rho	p-value	Interpretation
Technology Knowledge			
Culture of Innovation	0.850**	< .001	Highly Significant
Personalized Learning	0.867**	< .001	Highly Significant
Using Data to Inform Instruction	0.823**	< .001	Highly Significant
Technology Skills			
Culture of Innovation	0.899**	< .001	Highly Significant
Personalized Learning	0.906**	< .001	Highly Significant
Using Data to Inform Instruction	0.869**	< .001	Highly Significant
Technology Disposition			
Culture of Innovation	0.903**	< .001	Highly Significant
Personalized Learning	0.885**	< .001	Highly Significant
Using Data to Inform Instruction	0.871**	< .001	Highly Significant

**. Correlation is significant at the 0.01 level

Analysis of the highest scoring indicators: Technology Skills and Personalized Learning value: 0.906, indicate a highly significant correlation, standing out with the highest weighted average, indicate that there is a very strong positive correlation between technical skills and personalized learning, showing the strong

correlations with culture of innovation (0.899**), personalized learning (0.906**) and using data to guide instruction (0.869**). This may be because a solid foundation of technical skills is critical to cultivating an environment conducive to innovation, and improved technical skills can enable educators to more effectively implement personalized learning strategies to meet the individual needs of students. Thomas (2021) studied the role of digital technology in supporting personalized learning, supporting this finding.

Among the average-weighted indicators, "Technical Knowledge" and "Technical Propensity" also show strong correlations with the same set of innovation practices, although slightly less than "Technical Skills". The rho values for “Technical Knowledge” were 0.850**, 0.867** and 0.823** respectively, while the correlations for “Technical Predisposition” were 0.903**, 0.885** and 0.871**. These findings suggest that not only technical knowledge but also propensity toward technology plays a crucial role in fostering a culture of innovation.

Although this metric does not have the lowest correlation coefficient (as all listed correlations are highly significant), the metric focused on "Using data to guide instruction" may be considered to have the smallest direct impact on technical skills, the correlation is 0.869**. This can be attributed to possible reasons including technical knowledge, although it has a positive impact on innovation culture, the complexity within educational settings and the need for more nuanced approaches to data analysis and may need to be related to other factors such as organizational structure, leadership etc. can fully realize its potential.

The data in the table illustrate the deep interdependence between technical skills, knowledge, dispositions, and innovative practices. A culture of innovation means not only embracing innovative technologies, but also creating an environment where technology is seamlessly integrated into the teaching and learning process. Personalized learning, driven by technology, can provide a customized educational experience that meets individual needs, further enhancing the innovation landscape. Using data to guide instruction is critical to making evidence-based decisions that drive improvements in educational outcomes.

Table 6 describes the relationship between technology development and professional development. As seen in the table, computed rho-values ranging from 0.808 to 0.856 indicate an extraordinarily strong direct relationship among the sub variables of technology development and professional development. There was a statistically significant relationship between technology development and professional development because the obtained p-values were less than 0.05. The significance of these correlation coefficients indicates that technology development support has an important impact on educators' professional development. Strong correlations indicate that technical competencies are intricately linked to key areas of professional development.

Table 6
Relationship Between Technology Development and Professional Development

Variables	rho	p-value	Interpretation
Technology Knowledge			
Service to Profession	0.817**	< .001	Highly Significant
Digital Literacy	0.824**	< .001	Highly Significant
Lifelong Learning	0.808**	< .001	Highly Significant
Technology Skills			
Service to Profession	0.854**	< .001	Highly Significant
Digital Literacy	0.838**	< .001	Highly Significant
Lifelong Learning	0.848**	< .001	Highly Significant
Technology Disposition			
Service to Profession	0.850**	< .001	Highly Significant
Digital Literacy	0.853**	< .001	Highly Significant
Lifelong Learning	0.856**	< .001	Highly Significant

**. Correlation is significant at the 0.01 level

The index analysis with the highest score is technical skills and lifelong learning, with an index value of 0.848, indicating a highly significant correlation. This indicator has the highest score, indicating an extraordinarily strong positive correlation between technical skills and lifelong learning. This may be because

educators with important levels of technology skills are more likely to engage in lifelong learning to continuously improve their technology application capabilities. The "technical skills" variable exhibits the highest weighted average, with particularly strong correlations with "service professions" (0.854), "digital literacy" (0.838) and "lifelong learning" (0.848). This suggests that proficiency in technology skills is critical to the professional development of educators.

"Technologically inclined" follows closely behind and is highly correlated with the same professional development aspects, indicating that a cheerful outlook towards technology is equally influential. The correlation for "service professions" is 0.850, for "digital literacy" 0.853, and for "lifelong learning" 0.856.

In terms of the analysis of the indicator with the lowest score, the indicator Technology Skills and Digital Literacy shows a value of 0.824. Although all correlations are extremely high, the correlation coefficient between technical knowledge and digital literacy is the lowest value listed. This may suggest that although technical knowledge and digital literacy are closely related, technical knowledge may influence professional development more broadly than just digital literacy.

Table 7
Relationship Between Innovation Practices and Professional Development

Variables	rho	p-value	Interpretation
Culture of Innovation			
Service to Profession	0.883**	< .001	Highly Significant
Digital Literacy	0.858**	< .001	Highly Significant
Lifelong Learning	0.873**	< .001	Highly Significant
Personalized Learning			
Service to Profession	0.876**	< .001	Highly Significant
Digital Literacy	0.861**	< .001	Highly Significant
Lifelong Learning	0.868**	< .001	Highly Significant
Using Data to Inform Instruction			
Service to Profession	0.905**	< .001	Highly Significant
Digital Literacy	0.893**	< .001	Highly Significant
Lifelong Learning	0.868**	< .001	Highly Significant

**. Correlation is significant at the 0.01 level

Table 7 illustrates the relationship between innovation practices and professional development. As seen in the table, computed rho-values ranging from 0.858 to 0.905 indicate a strong direct relationship among the sub variables of innovation practices and professional development. There was a statistically significant relationship between innovation practices and professional development because the obtained p-values were less than 0.05.

The table highlights the significant impact that a culture of innovation, personalized learning, and the use of data to guide instruction have on educators' professional growth. The correlation coefficient (rho) and significance level (p-value) of each factor shown in the table indicate the relationship between innovative practices (including innovative culture, personalized learning, and the use of data to guide teaching) and professional development (service careers, digital literacy, and lifelong learning). These highly significant correlation coefficients indicate that there is a strong positive relationship between innovative practices and professional development, indicating that the greater the extent to which educators adopt innovative practices in their professional development, the greater their success in service careers, digital literacy, and lifelong learning. Performance in learning is also better.

The value of the indicator "Using Data to Inform Instruction" and "Service to Profession" is 0.905, indicating that the two are highly significantly correlated. This indicator has the highest score, indicating that there is a strong connection between educators' use of data to guide teaching and their commitment to the service profession or a positive correlation. This may be because relying on data for decision-making enhances the professional practice of educators, allowing them to serve the educational profession more effectively. Some research results have supported this research indicator.

In terms of intermediate indicators, the variables "culture of innovation" and "personalized learning" follow

closely and are highly correlated with the same professional development aspects. The rho values for "Innovation Culture" are 0.883 for "Service Professions," 0.858 for "Digital Literacy," and 0.873 for "Lifelong Learning." Likewise, the correlations for "Personalized Learning" are 0.876, 0.861, and 0.868, respectively.

Since all listed correlations are remarkably high, "Personalized Learning and Lifelong Learning" with the lowest correlation coefficient, are the object of analysis. The value 0.868 still shows a highly significant correlation, and although the correlation coefficient for this indicator is not exceptionally low, it is the smallest among the correlations listed. This may suggest that while personalized learning is closely related to lifelong learning, there may be other factors, such as teacher self-efficacy or school culture, that also have a significant impact on lifelong learning. The data in the table reveal the complex interplay between innovative practice and professional development. It demonstrates that a comprehensive approach to education innovation, including a culture of innovation, personalized learning, and data-driven teaching, is critical to fostering a professional environment that values continuous learning and serves the profession.

Community of Practice Framework

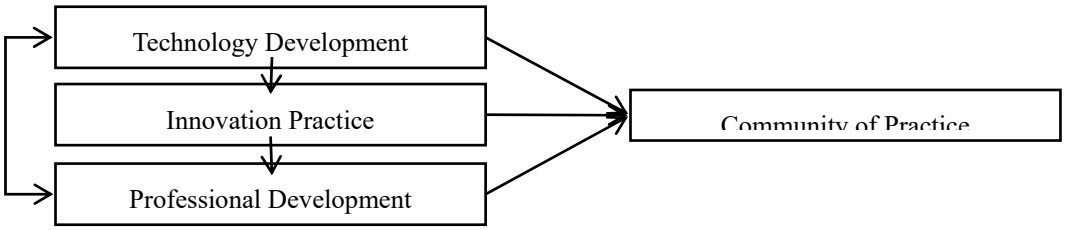

Figure 1: Community of Practice Framework

The constructive interaction between technological developments, innovative practices, and professional development is essential to foster a thriving community of practice among educators. Technology acts as an enabler, introducing new tools and platforms that pave the way for innovative teaching and learning approaches. By experiencing these technological advancements, educators embark on a journey of innovation, seeking creative solutions to educational challenges. Professional development appears to be an essential catalyst in this process. By equipping teachers with the skills and knowledge to effectively leverage technology, it empowers them to confidently implement innovative approaches. Additionally, professional development fosters a supportive environment where educators can learn from each other, share experiences, and build collaborative relationships. In essence, professional development, innovative practices, and teacher community are interconnected and mutually reinforcing elements. By investing in high-quality professional development, schools can create fertile ground for innovation, thereby improving teacher morale, student achievement, and a stronger educational community. Essentially, technological development, innovative practices, and professional development form a vicious circle that fosters the creation of strong teacher communities. By working together and harnessing the power of technology, educators can collectively shape the future of education and ensure students receive the best learning experience possible. The culmination of these interconnected elements is the formation of strong communities of practice. These communities provide spaces for teachers to explore, share knowledge, and solve problems together. Through collaborative efforts, educators can refine their innovative practices, stay abreast of technological advances, and continually improve their professional development.

4. Conclusions and recommendations

The study showed strong agreement on the respondent's technology development as to their technology knowledge, skills, and disposition. The respondents revealed strong agreement on the innovative practices in terms of culture of innovation, personalized learning and using data to inform instruction. The respondents strongly agreed on their professional development as to service to profession, digital literacy, and lifelong learning. There is a significant relationship among technology development, innovative practices, and professional development. A community of practice framework was developed to create a collaborative and

supportive environment where educators can share knowledge, experience, and best practices.

The following are the recommendations: To develop specific technology skills, teachers can effectively integrate technology into their classrooms, enhance student engagement, and improve overall teaching and learning outcomes. To effectively use data for instruction, teachers may create a data-driven culture using technology and set clear goals that improve learning outcomes and student results. The Human Resource managers may foster a strong professional development that may prioritize opportunities for teachers to contribute to the broader educational community. They may also encourage teachers to participate in professional learning communities (PLCs) and advocacy efforts can help them become influential change agents in their colleges, universities, and districts. Further, continuous learning opportunities can be provided to stay current with emerging technologies and their potential applications in education. The community of practice framework can be utilized by the colleges and universities to create a more supportive environment for the teachers. To advance knowledge in a field, future researchers must strive to extend existing research, fill research gaps, and consider broader implications. These involve replicating studies in different contexts, investigating under-researched areas, and exploring practical applications of research findings.

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