

College Teachers' Informatization-Based Teaching Ability and Performance

Zhitang Wang¹, Pamela B.Mantuhac^{2,*}

¹ Adamson University, Manila,1000, Philippines

² Adamson University Faculty, Manila,1000, Philippines

* **Corresponding author:** Pamela B.Mantuhac (Email: pamela.mantuhac@adamson.edu.ph)

Abstract: Teachers' informatization teaching ability is vital for integrating modern technology with educational practices, especially as technologies continue to evolve. These skills are critical for advancing the modernization of education and improving teaching quality, particularly in higher education. National policies in China, such as the "Education Informatization 2.0 Action Plan," highlight the importance of enhancing teachers' technological capabilities to meet the challenges of contemporary education. Focusing on the informatization teaching abilities of college teachers in Hunan Province, this research employed a descriptive quantitative method, gathering data from students and teachers at five universities. Significantly low to no correlation was shown between students' evaluations of teachers' technological proficiency and teachers' self-efficacy, though other factors, including in pedagogical strategies and digital resource integration, did not show significant relationships. Although college teachers have acquired basic informatization teaching skills, there remains room for improvement in areas like teaching implementation and evaluation. To address these gaps, targeted training programs, collaborative skill development initiatives, and up-to-date professional development aligned with technological advancements are recommended as strengthening these areas is essential for enhancing teachers' informatization capabilities and supporting the ongoing modernization of higher education in China.

Keywords: Education Management; Informatization Teaching Ability; Educational Technology; Higher Education; Teacher Self-Efficacy; Digital Resource Integration.

1. Introduction

Teachers' informatization teaching ability refers to a new type of teaching ability that effectively integrates information technology with subject teaching knowledge and uses information technology in teaching design, implementation, management and evaluation. It is also a new type of teaching ability for teachers to carry out teaching activities in an information-based environment. Important core competencies. In the 1990s, the concept of "education informatization" was proposed and gradually developed into a mainstream teaching method. At present, teachers' informatization teaching ability has become an important indicator for determining teacher quality in the new era, and has attracted widespread attention from educators around the world. China's "Education Informatization 2.0 Action Plan" proposes to actively promote "Internet + Education" and adhere to the core concept of deep integration of information technology and education and teaching. "China Education Modernization 2035" emphasizes "accelerating the reform of education in the information age and using modern technology to accelerate the reform of talent training models." The development of informatization teaching capabilities of college teachers is an effective way to promote the modernization of college education and improve the quality of education and teaching. With the deep integration of information technology and education and teaching, what are the informatization teaching capabilities of college teachers? What key factors influence its development? How to improve the information teaching capabilities of college teachers? Therefore, in-depth research on the information-based teaching ability of college teachers has become an important topic worthy of exploration.

Currently, the new generation of information technology represented by the Internet, big data, artificial intelligence, blockchain, 5G, etc. is booming. With the rapid progress of information technology and educational informatization, the informatization teaching ability of college teachers has become an indispensable ability of college teachers in the new era and a key factor in the quality of higher education talent training in the new era. Therefore, it has become crucial to improve the information-based teaching ability of college teachers, and it is necessary to conduct in-depth research on the informatization teaching ability of college teachers.

Hunan Province is located in central China and in the middle reaches of the Yangtze River. Its population ranks 7th in the country and its total education scale ranks 7th in the country. The province vigorously implements the strategy of revitalizing the province through science and education and accelerates the construction of a strong province in education. As of 2022, there are 164 higher education schools (institutions) in Hunan Province (including private ones), including 52 undergraduate colleges and universities, with 118,400 faculty and staff, including 86,900 full-time teachers (the above data source: Hunan Provincial People's Government Portal). In August 2018, Hunan was approved as the country's first National Education Informatization 2.0 pilot province. The province has successively issued the "Thirteenth Five-Year Plan for Educational Informatization in Hunan Province (2016-2020)" and the "14th Five-Year Plan for Educational Development in Hunan Province". The development level of education informatization in the province has been significantly improved and a path has been taken. The informatization development path with Hunan characteristics provides a model for reference for central provinces.

This study designed the "Questionnaire on the Informatization Ability of Teachers in Colleges and Universities", and used the questionnaire to survey the research objects, and finally analyzed the questionnaire data, combined with the interview survey, to clarify the factors that affect the informatization ability of teachers in Hunan colleges and universities, and finally proposed that Hunan colleges and universities Strategies for improving teachers' informatization capabilities.

The significance of this study lies in its comprehensive examination of the impact of teachers' informatization teaching ability on various stakeholders within the educational ecosystem. Assessing student perceptions, teacher performance, and the integration of digital resources, this research provides valuable insights that drive improvements in teaching practices, inform policy decisions, support professional development, and enhance the overall quality of education.

Hence, it can be beneficial to the following:

Students. This study is significant for students as it highlights the impact of teachers' informatization teaching ability on their learning outcomes and engagement. Understanding students' perceptions and assessments can lead to more effective and personalized teaching methods, thereby enhancing their overall educational experience and academic performance.

Teachers. Teachers will benefit from this study as it provides insights into their strengths and areas for improvement in using information technology in teaching. The findings can guide professional development programs and equip teachers with the necessary skills and strategies to effectively integrate technology into their pedagogy, ultimately improving their teaching efficacy and job satisfaction.

Policymakers. Policymakers will find this study valuable as it offers empirical data on the current status and challenges of informatization in teaching. This information can inform policy decisions related to educational technology, funding allocations, and the development of standards and guidelines for integrating digital tools into the curriculum.

Administrators. School administrators can use the insights from this study to support teachers in their professional growth and enhance the overall quality of education. The findings can help administrators identify specific needs for resources, training, and infrastructure improvements to foster a more technology-rich learning environment.

Schools. Schools can benefit from this study by gaining a comprehensive understanding of how informatization teaching practices affect student learning and teacher performance. The study's recommendations can help schools implement effective strategies to integrate technology in the classroom, leading to improved educational outcomes and better preparedness for the digital age.

Ministry of Education. The Ministry of Education can use the study's findings to develop and refine national education strategies and policies related to digital learning. The insights can help in designing targeted initiatives to enhance teachers' informatization teaching abilities, ensuring that education systems are aligned with global technological advancements and educational standards.

Future Researchers. Future researchers will find this study significant as it lays a foundation for further exploration into the impact of informatization in education. The study's

methodology, findings, and recommendations can serve as a reference point for subsequent studies, encouraging continued research into innovative teaching practices and the integration of technology in education.

This study aims to evaluate the informatization teaching ability of colleges and universities in Hunan Province. It is intended to select universities such as Hunan University of Technology, Hunan University of Science and Technology, Hunan Institute of Science and Technology, Hunan Institute of Information and Yongzhou Vocational and Technical College, to compile questionnaires in the three dimensions of Learning outcomes, Student engagement, Accessibility and inclusivity. Investigation, focusing on investigating the current status of informatization teaching ability of teachers in Hunan universities. Through investigations and interviews with the teacher's informatization teaching ability of Hunan universities, comprehensively understand the current situation of teachers' informatization teaching ability, explore the reasons for existing problems, and put forward more effective strategies and suggestions to promote the information teaching of teachers in Hunan universities.

2. Methodology

This chapter describes the study design and methodology. It also presents the study sites and participants, data collection tools and procedures, and data analysis.

Research Design

This study employed a descriptive quantitative method through a survey questionnaire. Analyzing the results of the questionnaire through statistical analysis method, the basic situation of the information technology teaching ability of colleges and universities, including the advantages and deficiencies of development, and exploring factors such as attitude, self-efficacy, and information ethics the degree of influence.

Sampling Method and Research Locale

This study adopts an online questionnaire survey method. Relying on the "Ask Volume Star" platform, 5 universities including Hunan University of Technology, Hunan University of Science and Engineering, Hengyang Normal University, Hunan University of Information Technology and Yongzhou Vocational and Technical College are distributed. These 5 universities include 3 Public undergraduate colleges, 1 private college and 1 vocational college. The research object is the full-time teacher of the above five samples. In order to ensure the representativeness of the sample, we set up questionnaire links or QR codes at the secondary college or department in the five colleges in the five colleges.

This study uses a convenient sampling method to select participants, and use the Qualtrics calculator to calculate the sample amount. The sample volume is selected for a total of 365 teachers. Given the sheer number of teachers, the researcher decided to use the same number of students, at 365, to match the total population of respondents.

The aforementioned were selected using purposive sampling and through the following criteria:

A teacher or student at any of the schools in this study's research locale;

Teaching or studying under a informatizaion-based technique of education;

Handled or participated in a course that requires informatization-based technique of education.

Research Instrument

The tools of this study are a questionnaire of "College Teacher Information Teaching Capability". The content of the questionnaire is based on Gonzalo Almerich's teacher information universal technology model and Southwest University Wu Min (2022) master's thesis. At the same time, it also refers to domestic and foreign information technology application capacity standards, including the ICT-CTF framework (2018 edition) issued by the United Nations.

The questionnaire structure mainly includes two parts. The first part of the content is related to the basic situation of the teachers, including gender, age, and discipline background. A total of 4 issues. The second part includes three aspects: learning outcomes, student engagement, accessibility and inclusivity. There are a total of 21 issues. Among them, the ability of informatization teaching capabilities starts from the current teaching form, including three teaching forms: online teaching, offline teaching, and hybrid teaching. The questionnaire uses the four-point Likert scale to calculate the score: 4 – to a great extent, 3 – somewhat, 2 – to a little extent and 1- not at all.

In order to ensure the validity of the questionnaire the main component analysis method is used to analyze the multiple variables contained in the questionnaire. The Cronbach Alpha trust factor method was used to analyze the reliability of the questionnaire. At the same time, the language part has also been reviewed by experts to ensure the consistency of its structure and tense, so that the questionnaires are clear and easy to understand.

Data Gathering Procedure

The researcher sought permission from the administrators of the selected five schools in Hunan Province to conduct the study.

After receiving approval, the researcher sought permission from the teacher respondents through an informed consent form. The questionnaires were then administered to the respondents either via a face-to-face or online platform, whichever is more convenient to the respondents. The data was immediately collated and tabulated, then sent to a statistical expert for statistical processing. This was followed by the analysis and interpretation of the data by the researcher.

Statistical Treatment of the Data

The results of the questionnaire was analyzed one by one. The statistical analysis software selected and used in this study is SPSS22.0. The statistical software function is comprehensive enough to meet the needs of this study. It also utilized the following:

Frequency and Percentage: Frequency refers to the number of times a particular value or category occurs in a dataset. Percentage is a way of expressing these frequencies relative to the total number of observations, providing a sense of proportion. These statistics are useful for summarizing categorical data and understanding the distribution of responses across different categories. For example, in a survey of students' perceptions, the frequency and percentage of students who rate their teachers' technological proficiency as high, medium, or low can be calculated to illustrate the overall distribution of responses.

Weighted Mean: The weighted mean is an average that takes into account the relative importance or frequency of different values. Unlike a simple arithmetic mean, where all values are treated equally, the weighted mean assigns different weights to each value based on their significance. This is particularly useful in educational research when different factors or responses have varying levels of

importance. For instance, when assessing student engagement, responses might be weighted differently based on the importance of various engagement indicators.

Standard Deviation: Standard deviation is a measure of the amount of variation or dispersion in a set of values. A low standard deviation indicates that the values tend to be close to the mean, while a high standard deviation suggests a wide range of values. This statistic is important for understanding the spread of data and identifying how consistent or varied the responses are. In analyzing teachers' informatization teaching ability, standard deviation can show the consistency of student ratings.

T-test: The t-test is a statistical test used to compare the means of two groups to determine if they are significantly different from each other. There are different types of t-tests, such as independent t-tests (comparing two separate groups) and paired t-tests (comparing two related groups). This test is useful for examining whether differences in variables like student engagement or learning outcomes are statistically significant between two distinct groups, such as male and female students or different grade levels.

Analysis of Variance (ANOVA): ANOVA is a statistical method used to compare the means of three or more groups to determine if at least one of the means is significantly different from the others. It helps in identifying whether variations in the data are due to the factor being studied or occur by chance. ANOVA is particularly useful in educational research when comparing the efficacy of different teaching methods across multiple groups or subjects.

Pearson Product-Moment Correlation: Pearson correlation measures the strength and direction of the linear relationship between two continuous variables. The correlation coefficient (r) ranges from -1 to 1, where 1 indicates a perfect positive correlation, -1 indicates a perfect negative correlation, and 0 indicates no correlation. This statistic is valuable for examining relationships between variables, such as the correlation between teachers' technological proficiency and student engagement levels.

3. Results, Analysis and Discussion

This chapter deals with the presentation, analysis, and interpretation of data gathered to answer the statement of the problems.

3.1. Profile of the Respondents

3.1.1. Students

Table 1 shows the demographic profile of student respondents. In terms of sex, the majority of the respondents are male, and a frequency of 228 or 62%, indicating a higher participation rate among males in the survey while females constitute a smaller portion of the respondents with a frequency of 137 or 38% which might indicate lower interest or accessibility to the survey among female students. The data implied a substantial difference in the sex distribution, with males being more prevalent than females. This could reflect various social, cultural, or environmental factors influencing the demographic composition of the population. Understanding these underlying factors could provide more insights into the causes of this disparity.

In terms of age, a significant majority of respondents, 330 or 90% are between 18-21 years old. 29 or 8% are 22-4 years old. There is minimal representation from age groups below 18 and above 22, with only 5 or 1% of respondents below 18 and less than 1% above 25. The findings likely reflect the

views and experiences of traditional college-aged students, particularly those in their late teens and early twenties. This narrow age range might limit the study's ability to generalize

findings across broader age demographics, especially if age-related differences are a point of interest in the research.

Table 1. Respondents' Demographic Profile Student Respondents

Variable	Categories	Frequency	Percentage
Sex	Male	228	62
	Female	137	38
	Total	365	100
Age	Below 18 years-old	5	1
	18-21 years-old	330	90
	22-24 years-old	29	8
	25 years-old and above	1	0.27
	Total	365	100
Year Level	First Year	83	23
	Second Year	120	33
	Third Year	84	23
	Fourth Year	78	21
	Total	365	100
Degree Program	Sciences	83	23
	Arts	120	33
	Business	84	23
	Education	25	7
	Others	53	15
	Total	365	100

The distribution across year levels is relatively balanced, with a slight overrepresentation of second-year students at 33%. First-year and third-year students each make up 23% of the sample, while fourth-year students comprise 21%. The balanced representation across different year levels implied that the study allows to capture a range of experiences and perspectives. This diversity can provide valuable insights into how experiences and perceptions evolve as student progress through their academic careers, enriching the study's findings.

In terms of degree programs, the Arts program has the highest representation at 33%, followed by Sciences and Business, each constituting about 23% of the sample. Education is the least represented with only 7% of respondents. The "Others" category accounts for 15%,

indicating a diverse range of other study areas. The dominance of Arts and Business students suggests that the study's outcomes may be more reflective of those fields. The underrepresentation of Education students may limit the generalizability of findings across all academic disciplines. This imbalance should be considered when interpreting the results, especially if the research involves comparing perspectives across different academic fields. To enhance representativeness, consider rebalancing the sample to include more female, older, and education program respondents.

3.1.2. Teachers

Table 2. Respondents' Demographic Profile Teacher-Respondents

Variable	Categories	Frequency	Percentage
Sex	Male	197	54
	Female	168	46
	Total	365	100
Age	25-35 years old	66	18
	36-45 years old	137	38
	46-55 years old	101	28
	Over 55 years old	61	17
	Total	365	100
Length of Work Experience	Less than a year	27	7
	1-5 years	132	36
	6-15 years	115	32
	16-25 years	60	16
	Over 25 years	31	8
	Total	365	100
Subject Taught	Sciences	87	24
	Arts	22	6
	Business	144	39
	Education	96	26
	Others	16	4
	Total	365	100

Table 2 shows the demographic profile of the teacher respondents. In terms of sex, out of the total respondents, 197 are male, which constitutes 54% of the population. While

there are 168 female respondents, making up 46% of the total. The gender distribution among respondents is relatively balanced, with a slight majority being male. This balance can

suggest a diverse perspective in the data collection process, potentially leading to more comprehensive insights.

In terms of age, the 25-35 years old age group includes 66 respondents, representing 18% of the total, 36-45 years old, or the largest age group with 137 respondents, makes up 38% of the population. There are 101 respondents in the 46-55-year-old category, accounting for 28% of the total. While 61 respondents or 17% of the population for over 55 years old age group. The age distribution indicates that the majority of respondents are in the 36-45 and 46-55 age brackets, which together account for 66% of the respondents. This middle-aged majority could influence the data with more established professional perspectives.

In terms of length of work experience, 27 respondents, making up 7% of the total, have less than a year of experience. The largest group, with 132 respondents (36%), have between 1 and 5 years of experience. 6-15 years category includes 115 respondents and represents 32% of the total. While 60 respondents fall into the 16-25 years category, making up 16% of the population. For over 25 years the most experienced group has 31 respondents, or 8% of the total. The respondents' work experience varies widely, with a significant portion (36%) having 1-5 years of experience. This suggests a mix of fresh and seasoned perspectives, with a tendency towards those with moderate experience.

In terms of subjects taught, 87 respondents, or 24%, teach sciences. 22 respondents are teaching Arts, representing 6% of the total. The largest category with 144 respondents (39%) teaches business-related subjects. While the education category includes 96 respondents, making up 26% of the population. However, 16 respondents, or 4%, teach subjects outside the main categories. This implied that business and education subjects dominate the respondents' profiles, making up 65% of the total. This could indicate a focus or interest in these areas within the surveyed population, potentially impacting the study's outcomes.

The demographic profile provides a comprehensive view of the respondents, with a fair representation across different sexes, ages, work experience lengths, and subject areas. This diversity can enhance the robustness of the study, offering varied insights and perspectives.

3.2. Students' Perceptions of Their Teachers' Informatization Teaching Ability

3.2.1. Pedagogical Strategies

The survey indicates that students view their teachers' informatization teaching ability as minimal, with an overall mean of 1.75 (SD = 0.67). This suggests limited integration of digital methods in enhancing learning, highlighting the need for better technology integration (Chen & Wang, 2022; Liu & Yin, 2014).

Digital assignments ranked highest in student perceptions (mean = 1.86, SD = 0.81), but still fall within the "minimal" range, indicating limited engagement. While digital projects are part of the curriculum, their impact on learning is seen as insufficient, supporting literature on the strategic use of digital tools for better engagement (He, 2011; Wang & Ran, 2023).

Perceptions regarding the clarity of instructions for technology use received a mean of 1.79, suggesting that guidance is inadequate for effective integration. This points to a gap in instructional strategies necessary for successful technology use (Jiang & Han, 2018; Wang & Ran, 2023).

Students' perceptions of encouragement for collaborative

learning through digital platforms are minimal (mean = 1.78), indicating limited emphasis on digital collaboration. This reflects the need for stronger support for collaborative learning (Li, 2021; Sui et al., 2020).

The lowest-ranked perceptions are related to the integration of digital tools and multimedia in learning activities (mean = 1.68), showing that these resources are used sparingly and do not significantly aid understanding. This aligns with studies advocating for better use of multimedia and digital tools to improve teaching effectiveness (Zhang & He, 2015; Zhang et al., 2021).

3.2.2. Technological Proficiency

The survey shows that students perceive their teachers' informatization teaching ability as minimal, with an overall mean score of 1.71 (SD = 0.64). This indicates that while technology is used, it is not effectively integrated into various educational aspects, such as adaptability and engagement. These findings align with previous research highlighting the importance of technological proficiency for improving educational outcomes (Chen & Wang, 2022; He, 2011).

Students rated teachers' adaptability in using new technologies with a mean of 1.74 (SD = 0.71), reflecting limited effectiveness. Although there are efforts to integrate new technologies, their impact on learning is perceived as insufficient, consistent with Jiang and Han's (2018) findings on the need for better integration.

Finally, perceptions of teachers' proficiency with digital tools and its impact on learning scored the lowest, with means of 1.68 and 1.67, respectively. These results indicate that students view teachers' technological skills as insufficient to positively influence their learning experiences. This underscores the need for targeted professional development to enhance teachers' digital proficiency and improve instructional clarity and engagement (Wang & Ran, 2023).

3.2.3. Integration of Digital Resources

The survey shows students' perceptions of their teachers' ability to integrate digital resources, with an overall mean of 1.70 (SD = 0.65), indicating minimal effectiveness. While digital resources are used, they do not significantly enhance instruction or engagement. This aligns with prior research highlighting the need for better integration of digital resources to meet diverse learning needs (Jiang & Han, 2018; Zhang & He, 2015).

Students rated the provision of diverse digital resources for different learning styles at 1.74 (SD = 0.72), suggesting that efforts to address various preferences have limited impact. The relevance and timeliness of these resources, rated at 1.72 (SD = 0.72), also indicate minimal enhancement of the learning experience, consistent with Liu and Yin's (2014) findings on alignment with educational needs.

Guidance for navigating digital resources for independent study received a score of 1.71 (SD = 0.68), suggesting insufficient support for self-directed learning. This lack of guidance reflects teachers' potential skills gap in effectively utilizing digital resources, as noted by Chen and Wang (2022).

Perceptions of digital resources supplementing classroom instruction and promoting interactive learning scored lower, with means of 1.69 and 1.68 (SD = 0.70), indicating ineffective enhancement of engagement. Wang and Ran (2023) also highlighted the need for more dynamic use of digital tools.

The lowest-ranked aspect, using digital resources to enhance understanding, scored 1.66 (SD = 0.68), emphasizing minimal impact on students' comprehension. This highlights

the need for more targeted and effective use of digital resources, a critical area for development noted in previous studies (Zhang & He, 2015). To improve integration, teachers should focus on enhancing the variety, relevance, and guidance of digital resources to create a more interactive and impactful educational experience.

3.3. Difference in Student Assessments of Their Teachers' Informatization Teaching Ability based on Their Profiles.

3.3.1. Teachers' Informatization Teaching Ability and Sex

The survey presents the differences in students' perceptions of their teachers' informatization teaching abilities based on sex. The overall mean perception score of 1.72, coupled with a t-value of -0.891 and a p-value of 0.373, indicates no significant difference in perceptions between male and female students. The p-value exceeding 0.05 suggests that the null hypothesis is accepted, affirming that sex does not significantly influence students' perceptions of informatization teaching ability. This finding is consistent with earlier research, which suggests that sex does not substantially affect perceptions of teaching effectiveness in the context of informatization (Han & Ge, 2018).

In terms of pedagogical strategies, female students had a slightly higher mean score (1.81) compared to male students (1.71), yet the t-value of -1.337 and p-value of 0.182 imply that this difference is not statistically significant. The absence of a significant difference is consistent with research indicating that both male and female students similarly perceive the pedagogical approaches of teachers when information technology is integrated (Mlambo & Rambe, 2020).

Hence, the findings demonstrate that sex does not significantly affect students' perceptions of their teachers' informatization teaching abilities. This suggests that improvements in informatization teaching strategies should be universally applied, without tailoring specifically to gender differences. Such an approach is advocated by Chen and Wang (2022), who argue for comprehensive training programs that enhance informatization teaching capabilities across the board, ensuring equal educational opportunities for all students.

3.3.2. Teachers' Informatization Teaching Ability and Age

The survey presents data on the differences in students' perceptions of their teachers' informatization teaching abilities across different age groups. The overall mean perception score of 1.61, with an F-value of 0.561 and a p-value of 0.64, indicates no significant difference in perceptions based on age. The p-value being greater than 0.05 supports the acceptance of the null hypothesis, suggesting that age does not significantly affect overall perceptions of informatization teaching ability (He, 2011).

For pedagogical strategies, students aged 22-24 years old reported the highest mean score of 1.83, while those below 18 years old had the lowest mean score of 1.37. Despite this variation, the F-value of 0.676 and p-value of 0.567 indicate that these differences are not statistically significant. This is consistent with findings from previous studies, which suggest that perceptions of pedagogical strategies are not significantly influenced by age (Wang & Ran, 2023).

Regarding technological proficiency, the mean scores ranged from 1.34 for students below 18 years old to 1.71 for

those aged 18-21 years old. However, the F-value of 0.566 and p-value of 0.637 show that these differences are not statistically significant. This aligns with research indicating that technological proficiency perceptions remain relatively consistent across different age groups (Sui et al., 2020).

In terms of the integration of digital resources, students aged 18-24 years old reported a higher mean score of 1.71 compared to those below 18 years old (1.37) and those aged 25 years and above (1.57). Despite these variations, the F-value of 0.457 and p-value of 0.712 suggest no significant difference in perceptions of digital resource integration. This finding is supported by research indicating that age does not significantly impact perceptions of digital resource effectiveness (Zhang, 2023).

The results imply that age does not significantly influence students' perceptions of their teachers' informatization teaching abilities across various areas, such as pedagogical strategies, technological proficiency, and the integration of digital resources. This suggests that teachers' approaches to technology integration are perceived consistently across different age groups. To enhance this consistency, educational institutions should focus on universal best practices in informatization teaching. Providing professional development opportunities that address these practices can help ensure that all students, regardless of age, benefit equally from technology-enriched learning environments. Additionally, collecting detailed feedback from different age groups could uncover any subtle differences in needs or preferences, allowing for more targeted improvements if necessary (Chen, 2021).

3.3.3. Teachers' Informatization Teaching Ability and Year Level

The survey displays the differences in students' perceptions of their teachers' informatization teaching ability across different year levels. The overall mean perception score of 1.72, with an F-value of 0.709 and a p-value of 0.547, indicates no significant difference in perceptions based on year level. Since the p-value is greater than 0.05, the null hypothesis is accepted, suggesting that year level does not significantly influence students' overall perceptions (Carlos, 2012).

For pedagogical strategies, first-year students reported a higher mean score of 1.88 compared to students in other year levels, whose scores ranged from 1.70 to 1.73. However, the F-value of 1.395 and the p-value of 0.244 indicate that these differences are not statistically significant. This is consistent with research indicating that perceptions of pedagogical strategies are generally uniform across different year levels (Chen & Wang, 2022).

In terms of technological proficiency, first-year students rated their teachers higher, with a mean score of 1.78, compared to other year levels, which ranged from 1.67 to 1.70. Despite this, the F-value of 0.474 and p-value of 0.700 show that the differences are not statistically significant. Previous studies also suggest that technological proficiency perceptions do not significantly vary by year level (Zhang & He, 2015).

Regarding the integration of digital resources, first-year students had a slightly higher mean score of 1.75 compared to other year levels, where scores ranged from 1.67 to 1.73. The F-value of 0.396 and p-value of 0.756 indicate that these differences are not statistically significant. This finding supports the idea that perceptions of digital resource integration remain consistent across year levels (Wang & Li,

2022).

Following the results, it is implied that students' year level does not significantly influence their perceptions of their teachers' informatization teaching abilities in areas such as pedagogical strategies, technological proficiency, and the integration of digital resources. This suggests that teachers maintain a consistent approach to technology integration regardless of students' year levels. To further enhance this consistency, schools should focus on providing ongoing professional development that addresses the needs of students at all levels. Additionally, collecting more detailed feedback from students at different year levels could help identify any subtle differences or specific needs that might improve informatization teaching for all students (Song & Yu, 2020).

3.3.4. Teachers' Informatization Teaching Ability and Degree Program

The survey shows the differences in students' perceptions of their teachers' informatization teaching ability across different degree programs. The overall mean perception score of 1.72 is consistent across all programs. With an F-value of 0.284 and a p-value of 0.888, the data suggest that there are no significant differences in perceptions based on degree program. Since the p-value is significantly above 0.05, the null hypothesis is accepted, indicating that degree programs do not significantly influence overall perceptions (Wu, 2022).

For pedagogical strategies, mean scores range from 1.71 in sciences to 1.85 in Arts, with other programs reporting similar scores between 1.72 and 1.76. The F-value of 0.253 and the p-value of 0.908 indicate that these differences are not statistically significant. This is consistent with the literature, suggesting that perceptions of pedagogical strategies remain similar across different degree programs (Chen & Wang, 2022).

The mean scores for technological proficiency range from 1.67 in sciences to 1.81 in Arts, with other programs showing scores between 1.68 and 1.73. The F-value of 0.311 and p-value of 0.870 reveal no significant differences. This aligns with previous research indicating that technological proficiency perceptions are generally consistent across programs (Han & Ge, 2018).

Overall, the analysis suggests that students' perceptions of their teachers' informatization teaching abilities are consistent across various degree programs. This indicates that the effectiveness of technology integration in teaching does not significantly vary by program. To maintain and enhance these positive perceptions, institutions should provide ongoing professional development for educators to uphold high technology standards across all programs (Chen, 2021). Additionally, gathering specific feedback from students in different programs could help identify any unique needs or preferences, enabling targeted improvements in teaching practices to further enhance the educational experience.

3.4. Teachers' Self-assessment on Their Efficacy on Informatization-based Teaching Performance

3.4.1. Learning Outcomes

The survey reveals teachers' self-assessment of their efficacy in informatization-based teaching performance concerning learning outcomes. The overall mean score of 1.72 suggests that teachers perceive their informatization-based teaching methods as having a minimal impact on learning outcomes, with a standard deviation of 0.66

indicating moderate variability in responses. This variability reflects some differences in perceptions among teachers, although the prevailing view is one of minimal impact. This general perception is consistent with findings from Chen (2020), who noted that technology integration in teaching often results in modest improvements in student achievement.

Teachers rate their proficiency in using technology to facilitate learning as slightly effective, with a mean of 1.67 and a standard deviation of 0.80, indicating limited confidence in their technological capabilities. This finding mirrors Han and Ge's (2018) conclusions on the need for better training in technological tools. Similarly, teachers' confidence that technology enhances students' achievement of learning goals, also with a mean of 1.67 and a standard deviation of 0.78, underscores the minimal belief in technology's role in achieving educational objectives, as observed by Chen (2021).

Hence, the findings suggest that teachers generally perceive their use of informatization-based teaching methods as having only a minimal impact on student learning outcomes. This indicates a need for targeted professional development programs that focus on enhancing teachers' skills in using technology effectively. Providing such support can improve teachers' confidence and proficiency, aligning technology use with learning objectives and potentially leading to more significant improvements in student outcomes (Chen & Wang, 2022; Han & Ge, 2018). Ongoing evaluation and feedback mechanisms should also be implemented to help teachers refine their approaches and better integrate technology into their teaching practices.

3.4.2. Student Engagement

The survey presents teachers' self-assessment of their efficacy in using informatization-based teaching methods to enhance student engagement. The overall mean score of 1.71, with a standard deviation of 0.67, indicates that teachers perceive their effectiveness in this area as minimal. This suggests that while technology is being integrated into teaching practices, teachers feel it only slightly improves student participation, motivation, collaboration, and attentiveness. This finding aligns with research by Zhang and He (2015), who noted that while technology can facilitate various aspects of teaching, its impact on student engagement often remains limited.

The highest mean score of 1.73 was reported for the indicator related to the belief that informatization-based methods encourage active student participation and engagement. The relatively low standard deviation of 0.77 suggests a degree of consistency in this perception among teachers. However, this score still reflects a belief in minimal impact, similar to the findings of Chen (2021), which highlight that technology's potential to boost active participation often falls short in practice.

Indicators ranked third, including perceptions that informatization-based teaching methods motivate students, enhance interest through multimedia, and promote equitable participation, all received a mean score of 1.72. The standard deviations ranged from 0.80 to 0.86, indicating moderate variability among teachers' perceptions. These scores suggest that despite the potential for technology to improve motivation and engagement, teachers believe its actual impact is limited. This is consistent with Han and Ge's (2018) findings, which suggest that while multimedia resources can enrich learning, their effectiveness in engaging students often depends on how well they are integrated into teaching

strategies.

The lowest-ranked indicator, related to teachers' satisfaction with student engagement through informatization-based teaching, received the lowest mean score of 1.68 and a standard deviation of 0.81. This further underscores the general perception of minimal efficacy in using technology to engage students. Overall, the findings indicate a consistent view among teachers that informatization-based methods have only a minimal impact on student engagement. This suggests a need for enhanced strategies and training to improve technology's role in fostering active participation, collaboration, and attentiveness. Educational institutions should invest in professional development that focuses on effective technology integration and provide resources for creating engaging multimedia content and interactive activities to better support student engagement (Chen & Wang, 2022; Han & Ge, 2018).

3.4.3. Accessibility and Inclusivity

The survey displays teachers' self-assessment of their effectiveness in using technology to improve accessibility and inclusivity in teaching. With an overall mean score of 1.73 and a standard deviation of 0.69, the data indicates that teachers perceive their use of technology as having only a minimal impact on enhancing accessibility and inclusivity for students. This suggests that while technology is integrated into teaching practices, its effectiveness in making learning more accessible and inclusive remains limited. This finding is consistent with the research by Guo and Xu (2017), which noted that despite technological advancements, the actual impact on accessibility often falls short.

The highest mean score of 1.77 was reported for the indicator related to teachers' satisfaction with accessibility and inclusivity achieved through technology integration. This score, with a standard deviation of 0.84, reflects some variability in teachers' responses but generally indicates a view of minimal effectiveness. Similarly, teachers perceive that technology somewhat improves accessibility to learning materials for students with diverse needs and promotes equal opportunities for engagement, both rated at 1.75. The higher standard deviations of 0.88 and 0.82, respectively, suggest differing perceptions among teachers, aligning with Tang and He's (2021) findings that technology's effectiveness in addressing diverse learning needs can vary significantly.

To address these challenges, educational institutions should prioritize professional development focused on inclusive technology practices and the use of diverse digital tools that cater to various learning needs. Clear guidelines and support systems for addressing accessibility challenges can further enhance the effectiveness of technology integration, ensuring that it supports equitable access and benefits all students (Huang & Zhang, 2020; Guo & Xu, 2017).

3.5. Difference in Teachers' Self-assessment on Their Efficacy on Informatization-based Teaching Performance based on Their Profiles

3.5.1. Teachers' Self-Assessment on Their Efficacy on Informatization-Based Teaching Performance and Sex

The survey examines the differences in teachers' self-assessment of their efficacy in informatization-based teaching performance based on sex. The results reveal that there are no significant differences between male and female teachers

across all evaluated aspects—learning outcomes, student engagement, accessibility, and inclusivity. The overall mean score of 1.71, with a p-value of 0.682, indicates that both genders perceive technology's impact on their teaching as minimal (Carlos, 2012). This uniform perception suggests that technology integration in education is viewed similarly by male and female teachers, emphasizing a general belief in its limited effectiveness.

Specifically, in the area of learning outcomes, the p-value of 0.914 confirms that there is no significant difference in how male and female teachers assess the impact of technology. Mean scores for male and female teachers are 1.71 and 1.72, respectively, reflecting a shared perception of minimal impact (Chen, 2021). This lack of distinction highlights that both genders have comparable views on how technology affects students' academic achievements.

Regarding student engagement, the data shows no significant gender-based difference, with a p-value of 0.544. Male teachers report a mean score of 1.73, while female teachers report 1.68. This result suggests that gender does not notably influence teachers' perceptions of technology's role in enhancing student participation, motivation, and interaction (Wang & Li, 2022).

Hence, the lack of significant differences in self-assessment based on sex suggests that the challenges associated with informatization in teaching are experienced similarly by male and female teachers. This indicates a need for universally applicable strategies to enhance technology integration. Educational institutions should focus on providing comprehensive professional development that addresses common issues, such as effective technology use and inclusive practices. Enhancing teachers' skills in these areas can improve technology's overall impact on teaching effectiveness, regardless of gender (Chu & Niu, 2021; Wang & Li, 2022).

3.5.2. Teachers' Self-assessment on Their Efficacy in Informatization-based Teaching Performance and Age

The survey illustrates significant differences in how various age groups assess the impact of technology on accessibility and inclusivity, with a p-value of 0.037. The mean scores for accessibility and inclusivity increase with age, ranging from 1.53 for the 25-35 age group to 1.86 for those over 55. This trend suggests that older teachers perceive technology as having a more positive impact on making learning environments more accessible and inclusive (Chen & Wang, 2022). This increased perception among older teachers may reflect their greater familiarity and comfort with technology, which could influence their assessment of its effectiveness in these areas.

In terms of learning outcomes, the differences in self-assessed efficacy of technology are not statistically significant, with a p-value of 0.056, just above the 0.05 threshold. Mean scores range from 1.53 for the 25-35 age group to 1.82 for those over 55, indicating some variation in perceptions but not enough to assert a significant impact (Chen, 2021). This suggests that while there may be differences in how various age groups view technology's effect on learning outcomes, these differences are not pronounced enough to be statistically significant.

Regarding student engagement, there is a significant difference in perceptions across age groups, with a p-value of 0.032. The 25-35 age group has the lowest mean score of 1.50, while older groups report higher scores, indicating that older

teachers perceive a greater impact of technology on student engagement (Chi, 2022). This finding highlights that age may influence how teachers view technology's role in enhancing student interaction and participation, with older teachers potentially recognizing more benefits in this area.

In contrast, the non-significant results for learning outcomes imply a consistent view across age groups regarding this aspect. Nonetheless, ongoing professional development remains important for all teachers to further improve their skills and perceptions related to technology's impact on learning outcomes. Overall, targeted support and training can help ensure that technology integration benefits teachers across all age groups (Sui et al., 2020).

3.5.3. Teachers' Self-assessment on Their Efficacy of Informatization-based Teaching Performance and Length of Work Experience

The analysis reveals that there are no significant differences in the assessment of technology's impact on learning outcomes, student engagement, and accessibility based on the length of teachers' work experience, as indicated by a p-value of 0.371. This suggests that teachers' overall perceptions of technology's effectiveness remain consistent regardless of their years of experience (Han & Ge, 2018).

For learning outcomes, the lack of significant differences, with a p-value of 0.334, implies that teachers with varying lengths of work experience generally have similar views on technology's impact on learning outcomes. This uniformity in perception indicates that the influence of technology on learning outcomes is perceived similarly across different experience levels (Wang & Ran, 2023).

Regarding student engagement, the p-value of 0.436 further supports the finding that differences in perceptions of technology's impact on student engagement across various lengths of work experience are not statistically significant. This indicates a general consensus among teachers with different levels of experience on how technology affects student engagement (Sui et al., 2020).

Similarly, the p-value of 0.350 for accessibility and inclusivity suggests that teachers with varying lengths of work experience have comparable views on the impact of technology in promoting accessibility and inclusivity. This indicates a consistent perception of technology's effectiveness in these areas across different levels of experience (Chen, 2021).

The uniformity in teachers' assessments of technology's impact across various lengths of work experience suggests that the perceived benefits and challenges associated with technology in education are experienced similarly, regardless of how long teachers have been working. To enhance technology integration, it is crucial to implement broad, comprehensive professional development programs that address general needs and challenges rather than focusing on specific experience levels. Continuous support, resources, and training for all teachers was essential in improving their proficiency with technology and its effectiveness in enhancing educational outcomes (Chen & Wang, 2022; Zhang, 2023).

3.5.4. Teachers' Self-Assessment on their Efficacy on Informatization-Based Teaching Performance and Subject Taught

The analysis reveals that there are no significant differences in the assessment of technology's impact on learning outcomes, student engagement, and accessibility based on the subject taught, with a p-value of 0.542. This

suggests that teachers' overall perceptions of technology's effectiveness are similar, regardless of the subject they teach (Mlambo & Rambe, 2020).

In terms of learning outcomes, the lack of significant difference, with a p-value of 0.452, indicates that perceptions of technology's impact on learning outcomes are consistent across different subjects. Teachers' views on how technology influences learning outcomes do not vary significantly by subject (Sui et al., 2020).

Similarly, the p-value of 0.387 for student engagement shows that there are no statistically significant differences in perceptions of technology's impact on student engagement across various subjects. This suggests that teachers' opinions on how technology affects student engagement are comparable across different disciplines (Chen & Wang, 2022).

For accessibility and inclusivity, the p-value of 0.357 indicates no significant variation in how teachers from different subject areas assess technology's impact on accessibility and inclusivity. This suggests that teachers' views on the effectiveness of technology in fostering an inclusive learning environment are consistent across subjects (Wang, 2023).

The uniformity in teachers' self-assessments of technology's impact across different subjects implies that the perceived benefits and challenges associated with technology integration are broadly similar, regardless of the subject matter. To enhance technology's overall effectiveness in education, it is essential to develop and implement universal strategies and resources that address general challenges and opportunities related to technology use. Comprehensive training and support that are applicable to all subjects help maximize the potential benefits of technology and ensure its effective integration into teaching practices (Carlos, 2012; Zhang, 2023).

3.6. Relationship between Student Assessments of Their Teachers' Informatization Teaching Ability and Teachers' Self-efficacy of Informatization-based Teaching Performance

This analysis explores the relationship between student assessments of their teachers' informatization teaching ability and teachers' self-efficacy in informatization-based teaching performance.

The very low positive correlation between students' assessments of teachers' pedagogical strategies and teachers' self-efficacy in informatization-based teaching is not significant, as indicated by the p-value of 0.905. This suggests that there is no meaningful relationship between how students perceive their teachers' pedagogical strategies and the teachers' confidence in their informatization-based teaching abilities (Chen, 2021).

In contrast, a significant low positive correlation was found between students' assessments of teachers' technological proficiency and teachers' self-efficacy in informatization-based teaching, with a p-value of 0.00001. This indicates that as teachers' self-efficacy in using technology increases, students' perceptions of their technological proficiency also tend to improve, though the correlation remains relatively weak (Mlambo & Rambe, 2020). The very low positive correlation between students' assessments of teachers' integration of digital resources and teachers' self-efficacy in informatization-based teaching is not significant, as shown by

the p-value of 0.968. This suggests that there is no significant relationship between how well students think their teachers integrate digital resources and the teachers' confidence in their informatization-based teaching abilities (Wang & Li, 2022).

Given the significant low positive correlation between technological proficiency and teachers' self-efficacy, focusing on enhancing teachers' confidence and skills in technology can positively impact student perceptions. Targeted professional development and training programs aimed at improving teachers' technological skills could help bridge gaps in student assessments of technological proficiency. Encouraging teachers to share best practices and resources for integrating technology in the classroom could further enhance their effectiveness and positively influence student evaluations (Chen & Wang, 2022).

For variables where no significant relationship was found, such as pedagogical strategies and integration of digital resources, it is important to explore other factors that might influence student assessments and teachers' self-efficacy. Conducting qualitative research, such as interviews or focus groups, could provide deeper insights into why these aspects do not show a significant correlation. Additionally, refining the criteria and methods used to evaluate pedagogical strategies and resource integration may help identify more effective ways to support teachers in these areas and better align them with student expectations and perceptions (Zhang, 2023).

4. Summary of Findings:

1) Profiles of the Respondents:

Students: Profiles were assessed based on sex, age, year level, and degree program.

Teachers: Profiles were assessed based on sex, length of experience, and subject taught.

2) Students' Perceptions of Informatization Teaching Ability:

Pedagogical Strategies: Students' perceptions of their teachers' pedagogical strategies were analyzed.

Technological Proficiency: Students evaluated their teachers' technological proficiency.

Integration of Digital Resources: Students assessed how well teachers integrated digital resources into their teaching.

3) Differences in Student Assessments Based on Profiles

Students: No significant differences were observed in student assessments of their teachers' informatization teaching ability based on sex, age, year level, or degree program.

Teachers: Teachers' informatization teaching ability assessments did not vary significantly based on their sex, age, length of experience, or subject taught.

4) Teachers' Self-Assessment on Informatization-Based Teaching Performance

Learning Outcomes: Teachers' self-assessments were made regarding their efficacy in achieving learning outcomes through informatization.

Student Engagement: Assessments included how effectively technology engaged students.

Accessibility and Inclusivity: Teachers evaluated how technology impacted accessibility and inclusivity in their teaching.

5) Differences in Efficacy Assessments Based on Profiles

Students: No significant differences were found in student assessments of informatization-based teaching efficacy based

on their sex, age, year level, or degree program.

Teachers: There were no significant differences in self-assessed efficacy in informatization-based teaching based on teachers' sex, age, length of experience, or subject taught.

6) Relationship Between Student Assessments and Teachers' Self-Efficacy

A significant low positive correlation – pertaining no correlation -- was found between students' assessments of teachers' technological proficiency and teachers' self-efficacy in informatization-based teaching, while other aspects, such as pedagogical strategies and digital resource integration, did not show significant relationships. Overall, there were no significant correlations between tech proficiency factors and teacher self-efficacy variables used in this study.

5. Conclusion

1) The analysis of profiles showed no significant differences in student or teacher assessments based on sex, age, length of experience, or subject taught. This suggests that the profiles of respondents did not notably impact their views or self-assessments related to informatization teaching.

2) Students' perceptions of their teachers' technological proficiency had a significant low positive correlation with teachers' self-efficacy in informatization-based teaching, while perceptions of pedagogical strategies and integration of digital resources did not show significant correlations.

3) There were no significant differences in student assessments of teachers' informatization teaching ability across various student profiles. This indicates a consistent perception of informatization teaching effectiveness among students, regardless of their profile characteristics.

4) Teachers' self-assessments did not show significant differences based on their profiles in terms of learning outcomes, student engagement, or accessibility and inclusivity. This implies uniformity in how teachers perceive their informatization-based teaching performance across different profile categories.

5) There were no significant differences in student assessments or teachers' self-assessments of informatization-based teaching efficacy based on profiles. This reflects a general consensus on the effectiveness of informatization-based teaching that is not influenced by demographic or experiential factors.

6) No significant relationship was found between students' assessments of teachers' technological proficiency and teachers' self-efficacy in informatization-based teaching. This highlights that the tech proficiency factors mentioned in this study did not affect teachers' self-efficacy.

6. Recommendations

To address the findings and enhance the effectiveness of informatization in teaching, the following recommendations are proposed. These suggestions aim to strengthen teachers' self-efficacy and improve student perceptions regarding the integration of technology in education. Focusing on targeted training and comprehensive support, institutions can bridge gaps in technology use and ensure that all educators benefit from enhanced professional development opportunities.

Hence, the study features the following recommendations:

Develop and offer training programs tailored to different age groups, recognizing that older teachers perceive technology more positively, which ensures that younger teachers also receive adequate support and skill development.

Prioritize a collaborative environment that improve teachers' technological skills, given the significant correlation between technological proficiency and self-efficacy.

Provide targeted workshops on effectively integrating digital resources into teaching practices, addressing the lack of significant correlation found between digital resource integration and self-efficacy.

Foster a collaborative and inclusive environment where teachers can share best practices and resources for technology integration, which can help improve overall efficacy and student perceptions.

Ensure that professional development content remains current with the latest technological advancements and pedagogical strategies, as perceptions of technology's impact are consistent across different teaching subjects.

Explore additional factors affecting student assessments and teachers' self-efficacy through qualitative methods, such as interviews or focus groups, to gain deeper insights into the lack of significant correlations in some areas.

Design broad support mechanisms that address general needs and challenges of technology integration, rather than focusing solely on specific experience levels.

Continuously evaluate the effectiveness of professional development programs and make adjustments based on feedback and evolving needs to ensure they effectively improve technology integration.

Create and implement strategies that address common challenges associated with technology use in education, ensuring that all teachers can benefit from improved practices regardless of their teaching subject or experience level.

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