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Integration of MOOC-based-Flipped Classroom To Develop Digital Competence of Freshmen A Quantitative Study: Fostering Digital Competence of TUTE Freshmen

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***Abstract*:- The rapid advancement of digital technologies has transformed the landscape of higher education, necessitating the development of digital competence among students to ensure their academic success and future employability. This study investigates the effectiveness of massive open online course (MOOC)-based flipped classrooms in fostering digital competence among freshmen at TUTE. It explores the relationships between digital competence, student digital competencies learning motivation, and digital competencies learning progress in this learning environment. A quantitative-method approach was employed, and quantitative data was collected through pre-and post-test assessments, survey data was obtained it was designed to measure Digital competence skills influenced by the MOOC-based-flipped classrooms approach. The findings reveal a significant improvement in digital competence across various skill categories, including general digital concepts, operational skills, creativity, information navigation, mobile device skills, and social skills. Additionally, a strong positive correlation was found between digital competence and both motivation and Digital competencies learning progress. These results indicate that the MOOC-based flipped classroom model is effective in enhancing digital competence among freshmen and supports the notion that developing digital competence is essential for academic success.**

Based on the study's findings, several recommendations for future research and educational practice are proposed. These include conducting longitudinal studies to assess the long-term effects of MOOC-based flipped classrooms on digital competence development, incorporating this approach into curricula, exploring its effectiveness in diverse educational contexts, tailoring learning materials and instructional strategies to individual student needs, providing adequate training and support for educators, and ensuring the necessary technological infrastructure is in place. This study contributes to the growing body of literature on the impact of innovative pedagogical approaches in higher education, particularly those that leverage digital technologies to enhance learning outcomes. The results support the adoption of MOOC-based flipped classrooms as a promising strategy for fostering digital competence, which is crucial for students' academic success and future career prospects in the digital era.

Keywords: Digital technologies, Higher education, Digital competence, Massive Open Online Courses (MOOC), Flipped classrooms, freshmen

INTRODUCTION

1.1. Background and Context

The rapid digitalization of the modern world has led to an increased demand for digital competence among university students (Carretero, Vuorikari, & Punie, 2017). Digital competence is a critical skill set encompassing the effective and responsible use of digital technologies, including information management, communication, collaboration, and problem-solving (Ferrari, 2013). The need for digitally competent individuals is particularly evident in the job market, as employers increasingly require graduates to possess strong digital skills (European Commission, 2018).

Massive Open Online Courses (MOOCs) have emerged as a powerful tool in higher education, providing students with flexible and accessible learning opportunities (Liyanagunawardena, Adams, & Williams, 2013). MOOCs enable learners to access high-quality content and resources from renowned institutions, fostering a global learning community (Hew & Cheung, 2014). They also promote self-directed and lifelong learning, which are vital for digital competence development (Alvarez, Guasch, & Espasa, 2020).

Flipped classrooms, another innovative pedagogical approach, have gained popularity for their potential to enhance student engagement and learning outcomes (Bergmann & Sams, 2012). By reversing the traditional teaching approach, students explore learning materials independently before engaging in collaborative in-class activities (Abeysekera & Dawson, 2015). This method promotes active learning and allows educators to provide personalized feedback and support (O'Flaherty & Phillips, 2015).

Integrating MOOCs with flipped classroom methodologies can offer a synergistic effect, combining the strengths of both approaches to foster digital competence development among freshmen students (Alvarez et al., 2020). By utilizing MOOCs as a source of pre-class learning materials, educators can design engaging in-class activities that focus on developing essential digital skills (Kong, 2014). Moreover, this integration can encourage students to collaborate, communicate, and critically evaluate digital content, further enhancing their digital competence (Sánchez-Vera, León-Urrutia, & Davis, 2015).

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the integration of a MOOC-based flipped classroom has the potential to significantly contribute to the development of digital competence in freshmen students. By leveraging the strengths of MOOCs and flipped classrooms, educators can create engaging and effective learning environments that prepare students for the challenges of the digital world (Alvarez et al., 2020)..

1.2. Purpose and Objectives

The purpose of this study is to investigate the effectiveness of integrating MOOC-based flipped classrooms in developing digital competence among freshmen students at Tianjin University of Technology and Education. The objectives include:

- To analyze the role of MOOCs in flipped classroom implementation in relation to Digital competencies,
- To evaluate the digital competence development status in freshmen students
- To analyze the relationship between MOOC-based-flipped classroom and digital competencies.

1.3. Scope and Limitations

The study focuses on the implementation of MOOC-based flipped classrooms in higher education institutions and its impact on freshmen students' digital competence development. Within this context, the study aims to explore the integration of MOOC content and flipped classroom methodologies, as well as their combined influence on digital competence development (Alvarez et al., 2020). It does not address MOOCs or flipped classrooms in isolation, nor does it discuss other pedagogical approaches in detail, such as blended learning, problem-based learning, or traditional lecture-based teaching (Bergmann & Sams, 2012; Liyanagunawardena et al., 2013).

The study is limited to the experiences of freshmen students and their perceived digital skills after a Semester course completion, as they represent a unique population in higher education who are in the early stages of developing digital competence (Carretero et al., 2017). As such, the findings may not be generalizable to other student populations, such as upper-level undergraduates, graduate students, or non-traditional adult learners. Additionally, the study does not include the perspectives of educators or other stakeholders, such as instructional designers, administrators, or policymakers, who may have valuable insights into the challenges and opportunities associated with implementing MOOC-based flipped classrooms (O'Flaherty & Phillips, 2015).

Another limitation of the study is its focus on a single higher education institution, which may limit the generalizability of the findings to other institutions with different resources, student demographics, or institutional cultures (Hew & Cheung, 2014). Furthermore, the study does not explore the long-term effects of MOOC-based flipped classrooms on digital competence development or the potential influence of contextual factors, such as students' prior experiences, motivation, or learning preferences (Kong, 2014).

Despite these limitations, the study can provide valuable insights into the potential benefits and challenges of integrating MOOC-based flipped classrooms in higher education settings, contributing to the growing body of literature on innovative pedagogical approaches for digital competence development (Alvarez et al., 2020).

Abbreviations: H.E: Higher Education, TUTE: Tianjin University of Technology and Education

2. LITERATURE REVIEW

2.1. Massive Open Online Courses (MOOCs) in Education

MOOCs have become a popular learning resource, offering open access to a diverse range of subjects, including traditional academic disciplines, vocational training, and professional development (Liyanagunawardena, Adams, & Williams, 2013). Developed by renowned institutions and experts, MOOCs provide high-quality educational content that can enhance the learning experience by providing students with the flexibility to learn at their own pace and according to their preferred learning style (Alvarez et al., 2020).

MOOCs have gained widespread recognition for their potential to democratize education by removing geographical, financial, and institutional barriers to learning (Hew & Cheung, 2014). Through online platforms, students from diverse backgrounds can access MOOCs, fostering a global learning community that encourages knowledge exchange and cross-cultural understanding (Liyanagunawardena et al., 2013). Additionally, MOOCs have been hailed for their potential to promote lifelong learning, as they enable learners to continuously update their skills and knowledge throughout their careers (Alvarez et al., 2020).

Despite their numerous benefits, MOOCs also face several challenges, such as low completion rates, varying quality of course content, and the need for effective assessment and accreditation mechanisms (Koller, Ng, Do, & Chen, 2013). Researchers have suggested that integrating MOOCs into traditional higher education curricula and pedagogical approaches, such as flipped classrooms, can help address some of these challenges and enhance their effectiveness (Kong, 2014).

MOOCs have the potential to significantly impact education by offering flexible, accessible, and high-quality learning opportunities (Liyanagunawardena et al., 2013). However, integrating MOOCs with other pedagogical approaches, such as flipped classrooms, may be necessary to fully realize their potential and overcome the challenges they face (Alvarez et al., 2020).

2.2. Flipped Classroom: Concept and Implementation

The flipped classroom model involves reversing the traditional teaching approach, with students exploring learning materials independently before engaging in collaborative in-class activities (Bergmann & Sams, 2012). This pedagogical method shifts the focus from passive information transmission to active learning, requiring students to take responsibility for their own learning and apply their knowledge during in-class sessions (O'Flaherty & Phillips, 2015).

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The implementation of a flipped classroom generally involves two main components: pre-class and in-class activities (Bishop & Verleger, 2013). Pre-class activities typically include accessing and reviewing course materials, such as video lectures, readings, or multimedia content, which provide students with the foundational knowledge needed for in-class activities (Kim, Kim, Khera, & Getman, 2014). In-class activities, on the other hand, involve collaborative learning experiences, such as group discussions, problem-solving exercises, or case studies, which allow students to apply, analyze, and synthesize the knowledge gained during pre-class activities (Abeysekera & Dawson, 2015).

The flipped classroom model has been associated with various benefits for both students and educators. For students, the model can promote active learning, enhance engagement, and foster critical thinking skills (Bishop & Verleger, 2013). Research has also suggested that flipped classrooms can lead to improved learning outcomes, increased retention rates, and higher levels of student satisfaction (O'Flaherty & Phillips, 2015). For educators, the model allows for more efficient use of class time, enabling them to focus on higher-order cognitive activities and provide personalized feedback and support to students (Bergmann & Sams, 2012).

However, implementing a flipped classroom also presents challenges, such as the need for adequate technological infrastructure, the time required for creating and curating pre-class materials, and the potential for increased workload for both students and educators (Kim et al., 2014). To overcome these challenges, institutions may need to provide support and resources, such as professional development opportunities and access to high-quality learning materials, to facilitate successful flipped classroom implementation (O'Flaherty & Phillips, 2015).

The flipped classroom model offers a promising approach to enhance students' engagement and learning outcomes by promoting active learning and fostering critical thinking skills (Abeysekera & Dawson, 2015). Integrating this model with other pedagogical approaches, such as MOOCs, may further contribute to the development of digital competence among students (Alvarez et al., 2020).

2.3. Digital Competence: Definition and Framework

Digital competence is defined as the ability to use digital technology, communication tools, and networks effectively to access, manage, and share information (Carretero et al., 2017). It is a crucial skill for students in the digital era and is considered one of the key competencies for lifelong learning (European Commission, 2018). Digital competence encompasses a wide range of skills and knowledge, including information management, communication, collaboration, creativity, problem-solving, and critical thinking, as well as an understanding of ethical and legal considerations related to digital technology use (Ferrari, 2013).

Several frameworks have been developed to conceptualize and measure digital competence, with one of the most widely recognized being the European Commission's Digital Competence Framework (DigComp) (Carretero et al., 2017). The DigComp framework identifies five key areas of digital competence:

- Information and data literacy: The ability to locate, retrieve, evaluate, and manage digital information effectively (Vuorikari et al., 2016).
- Communication and collaboration: The ability to use digital tools to communicate, share, and collaborate with others, both within and beyond one's immediate network (Carretero et al., 2017).
- Digital content creation: The ability to create, edit, and improve digital content using various tools, platforms, and media (Vuorikari et al., 2016).
- Safety: The ability to protect oneself and others from potential risks and threats associated with digital technology use, including issues related to privacy, data protection, and digital identity management (Carretero et al., 2017).
- Problem-solving: The ability to identify, analyze, and solve problems using digital tools and resources, as well as the capacity to adapt to new technological developments and innovations (Vuorikari et al., 2016).

Developing digital competence is essential for students, as it enables them to navigate the increasingly complex digital landscape and prepares them for success in a rapidly changing job market (European Commission, 2018). Integrating digital competence development into higher education curricula and pedagogical approaches, such as MOOC-based flipped classrooms, can help ensure that students are equipped with the skills they need to thrive in the digital era (Alvarez et al., 2020).

2.4. The Role of MOOC-Based Flipped Classroom in Digital Competence Development

Integrating MOOCs into flipped classrooms can provide students with a rich variety of learning resources, leading to an enhanced learning experience and the development of digital competence (Alvarez et al., 2020). This approach can foster self-directed learning, collaboration, and problem-solving skills, all of which are essential components of digital competence (Carretero et al., 2017).

By exposing students to MOOC content in a flipped classroom setting, they are required to engage with diverse digital resources, such as video lectures, interactive simulations, and online discussion forums (Liyanagunawardena et al., 2013). This engagement helps students develop their information and data literacy skills, as they learn to locate, evaluate, and manage digital information effectively (Vuorikari et al., 2016). Moreover, the use of MOOC platforms for pre-class activities encourages students to take responsibility for their learning and develop the self-regulation skills necessary for success in digital environments (Kong, 2014).

During in-class activities, MOOC-based flipped classrooms facilitate communication and collaboration among students, as they work together to apply, analyze, and synthesize the knowledge gained from MOOC content (Abeysekera & Dawson, 2015). This collaborative learning experience fosters the development of digital communication and teamwork skills, as students use digital tools to share ideas, provide feedback, and solve problems (Carretero et al., 2017).

Furthermore, MOOC-based flipped classrooms can support digital content creation and problem-solving skills by incorporating project-based or inquiry-based learning activities that require students to create digital artifacts or develop solutions using digital

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tools (Bishop & Verleger, 2013). By engaging in these activities, students can enhance their creativity, critical thinking, and adaptability, which are essential for navigating the complex digital landscape (Vuorikari et al., 2016).
The integration of MOOCs into flipped classrooms may also promote digital safety awareness, as students encounter various ethical, legal, and privacy-related issues in their online learning experiences (Hew & Cheung, 2014). Through discussions and reflections, students can develop a better understanding of the importance of digital safety and responsible technology use (Carretero et al., 2017).
The integration of MOOC-based flipped classrooms can play a significant role in developing digital competence among students by promoting self-directed learning, collaboration, problem-solving, and digital safety awareness (Alvarez et al., 2020). By leveraging the strengths of both MOOCs and flipped classrooms, educators can create a powerful learning environment that fosters the development of essential digital skills (Carretero et al., 2017).

3. METHODOLOGY

3.1. Research Design

This study employed a quantitative approach using a survey design to assess the impact of MOOC-based flipped classrooms on the digital competence development of freshmen students. A cross-sectional survey was used to collect data from participants at a single point in time, at the end of the course semester following the implementation of the MOOC-based flipped classroom approach (Creswell & Creswell, 2018).
The quantitative research design was chosen for its ability to provide measurable and generalizable data, enabling the researchers to establish relationships and patterns between variables (Muijs, 2011). In this study, the independent variable was the MOOC-based flipped classroom approach, and the dependent variable was the digital competence development of freshmen students. The survey design allowed for the collection of large-scale data, enhancing the external validity and generalizability of the findings (Bryman, 2016).
To ensure the internal validity and reliability of the study, standardized survey instruments, such as the European Commission's Digital Competence Framework (DigComp) or other validated digital competence assessment tools, were utilized to measure the digital competence of participants (Carretero et al., 2017). Additionally, the researchers adopted rigorous data collection and analysis procedures, including clear sampling strategies, accurate data coding, and appropriate statistical tests to analyze the data (Creswell & Creswell, 2018).
The quantitative survey design provided a suitable method for investigating the impact of MOOC-based flipped classrooms on the digital competence development of freshmen students. By utilizing standardized assessment tools and rigorous data collection and analysis procedures, the researchers aimed to generate reliable and valid findings that contributed to the understanding of the effectiveness of this pedagogical approach in fostering digital competence (Bryman, 2016).

3.2. Participants and Sampling Strategy

The participants included freshmen students from a higher education institution in China known as Tianjin University of Technology and Education, enrolled in a course program that integrated a MOOC-based flipped classroom. Stratified random sampling was used to select a representative sample of students based on their demographics, such as gender, age, and academic major (Creswell & Creswell, 2018). In total, 200 participants were selected initially for the study, and the Total number of all students who attended the program was 233.
Stratified random sampling ensured that the sample was representative of the diverse student population, increasing the external validity of the study's findings (Bryman, 2016). By considering demographics such as gender, age, and academic major, the researchers aimed to account for potential differences in digital competence development that might be influenced by these factors (Carretero et al., 2017).
To recruit participants, the researcher contacted the course instructor and obtained permission to administer the survey. An email invitation was sent to all students enrolled in the course, explaining the purpose of the study and the voluntary nature of their participation. Students who agreed to participate provided informed consent before completing the survey (Creswell & Creswell, 2018). To protect participants' privacy and ensure confidentiality, all data collected in the study were anonymized and securely stored (American Psychological Association, 2017).
The researcher employed a stratified random sampling strategy to recruit a representative sample of freshmen students enrolled in a MOOC-based flipped classroom course as a result 143 agreed to participate and 143 Valid survey responses were retrieved. This approach enhanced the external validity of the study and allowed the researchers to investigate the impact of the pedagogical approach on digital competence development across diverse student demographics (Bryman, 2016).

3.3. Data Collection and Instruments

Quantitative data were collected through an online survey questionnaire, administered to participants after they completed the course with the MOOC-based flipped classroom approach. The survey comprised three sections: 1) demographic information, 2) a validated digital competence assessment tool (Carretero et al., 2017), and 3) a set of items measuring students' perceptions of the MOOC-based flipped classroom approach.
The digital competence assessment tool evaluated students' abilities across various dimensions, such as information management, communication, problem-solving, and collaboration. This tool allowed for the objective measurement of digital competence development and provided data that could be compared with established benchmarks or previous studies (Carretero et al., 2017).and Van Deursen (2014)

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The perceptions section included items related to student satisfaction, engagement, and perceived learning outcomes. These items provided insights into the students' experiences with the MOOC-based flipped classroom approach, as well as their opinions on its effectiveness in promoting digital competence development (Alvarez et al., 2020). This section of the survey utilized a Likert-scale format, allowing participants to rate their agreement or disagreement with various statements.

To ensure the reliability and validity of the survey instrument, the researchers conducted a pilot study with a smaller sample of students who had previously completed the course. This allowed for the identification and refinement of any problematic items or response options, as well as an assessment of the survey's overall usability and functionality (Creswell & Creswell, 2018).

3.4. Data Analysis Procedures

Quantitative data were analyzed using descriptive statistics, including means, standard deviations, and frequencies, to summarize participants' demographic information, digital competence scores, and perceptions of the MOOC-based flipped classroom approach. Inferential statistics, such as independent sample t-tests and analysis of variance (ANOVA), are employed to examine differences in digital competence scores and freshmen perceptions based on demographic factors. Additionally, correlation analyses are conducted to explore the relationships between digital competence scores and students' perceptions of the MOOC-based flipped classroom approach.

4. RESULTS

This research study aimed to investigate the integration of MOOC-based flipped classrooms for digital competence development among freshmen students. The analysis focused on various digital skill categories, including general definition, operational, information navigation, social, creativity, and mobile device skills. Descriptive statistics, reliability analysis, and validity analysis were employed to examine the data.

Figure1 illustrates the Major programs of freshmen students at a designated H.E institution

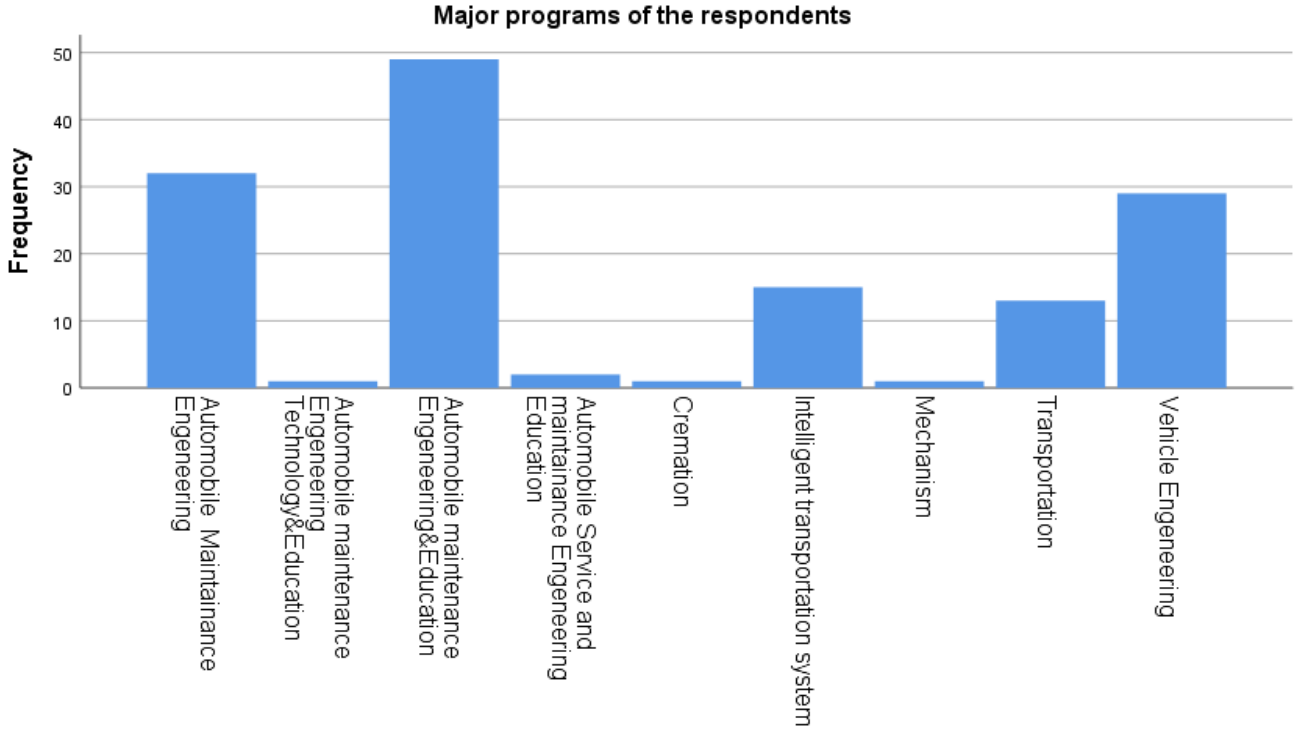

Figure2 Illustrates the demography of freshmen students (age)

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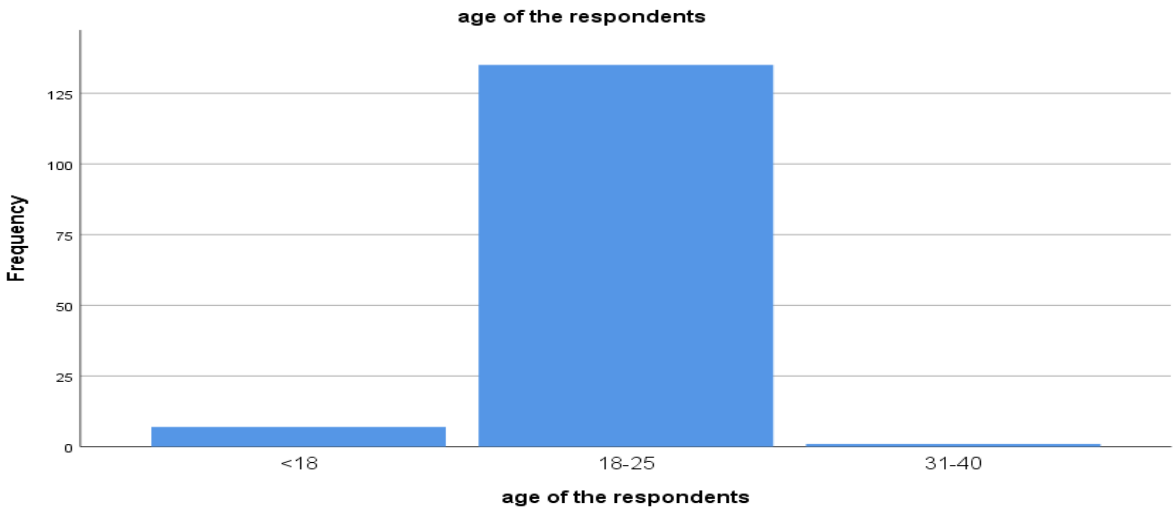

Table 1: Frequency and Gender Statistics

Gender	Frequency
Male	93
Female	40
Missing values	10
Total Participants	143

Table 1 presents frequency and gender statistics for a particular dataset. The dataset includes information on the number of male and female individuals in the sample, as well as the number of missing data points. Specifically, the table indicates that there are a total of 93 male individuals and 40 female individuals in the dataset. Additionally, there are 10 data points that are missing or unknown.

The descriptive statistics reported mean scores, standard deviations, and sample sizes (N) for each skill category. In the general definition category, the mean score was 4.52 (SD = 0.879, N = 143). For digital operational skills, 15 subcategories were identified with mean scores ranging from 3.63 to 4.58 (SD = 0.680 to 1.243, N = 143 or 144). Digital Information navigation skills had 10 subcategories, with mean scores varying from 3.24 to 4.29 (SD = 0.976 to 1.317, N = 143 or 144). Digital Social skills comprised 10 subcategories, with mean scores ranging from 4.07 to 4.46 (SD = 0.649 to 0.955, N = 141, 143, or 144). Digital Creativity skills included nine subcategories, with mean scores from 3.07 to 4.26 (SD = 0.985 to 1.392, N = 143 or 144). Lastly, Digital mobile device skills consisted of three subcategories, with mean scores ranging from 4.33 to 4.38 (SD = 0.784 to 0.828, N = 144). Cronbach's Alpha was used to assess the internal consistency of the Creativity Skill scale, Information Navigation Skill scale, and Mobile Device Skill scale. The Creativity Skill scale exhibited high internal consistency ($\alpha = 0.988$; $\alpha\_standardized = 0.991$). Similarly, the Information Navigation Skill scale demonstrated acceptable internal consistency ($\alpha = 0.723$; $\alpha\_standardized = 0.781$). The Mobile Device Skill scale showed excellent internal consistency ($\alpha = 0.970$; $\alpha\_standardized = 0.971$).

The convergent validity of the Internet Operational Skills scale was assessed using Pearson correlation coefficients. The results indicated strong and statistically significant correlations between all pairs of items at the 0.01 level (1-tailed), supporting the convergent validity of the scale. Moreover, strong and significant correlations between the Internet Operational Skills items and the two items related to motivation and learning progress (item 2/1 and 2/2) were observed at the 0.01 level (1-tailed), suggesting that individuals with higher levels of Internet Operational Skills also reported higher levels of motivation and learning progress.

The internal consistency of the Social Skills scale was assessed using Cronbach's Alpha. The results demonstrated high internal consistency ($\alpha = 0.988$; $\alpha\_standardized = 0.990$), indicating that the items on the scale reliably measured the same underlying construct, i.e., social skills.

5. DISCUSSION

The integration of MOOC-based flipped classrooms for digital competence development in freshmen has been analyzed using various skill categories, including general definition, operational, information navigation, social, creativity, and mobile device skills. Each of these skill categories was explored by examining descriptive statistics, reliability analyses, and Pearson correlations.

The findings revealed a range of mean scores across different skill categories, with the general definition having the highest mean score of 4.52 (SD = 0.879). This suggests that the integration of MOOC-based flipped classrooms is effective in improving freshmen's overall digital competence, as they demonstrate a strong understanding of general digital concepts. Similarly, mobile device skills showed high mean scores, ranging from 4.33 to 4.38 (SD = 0.784 to 0.828), which implies that students are adept at using mobile devices for learning purposes (Wang et al., 2019).

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The operational skill category displayed 15 subcategories with varying mean scores and standard deviations. A high degree of correlation was observed between operational skill variables, ranging from 0.726 to 0.975. These strong positive relationships suggest that operational skills are interconnected and that the development of one skill may facilitate the development of others (Chen et al., 2021). However, it is crucial to consider the potential issue of multicollinearity, which could affect the results of regression analyses (Hair et al., 2014).

The reliability analyses for the creativity, information navigation, and mobile device skills revealed high levels of internal consistency, as evidenced by Cronbach's Alpha values of 0.988, 0.723, and 0.970, respectively. These results indicate that the scales used for measuring these skills are reliable and measure a similar underlying construct (Tavakol & Dennick, 2011). Moreover, the convergent validity of the internet operational skills scale was supported by the strong and statistically significant correlations between all pairs of items.

The strong correlations between the operational skills items and the items related to motivation and learning progress suggest that students with higher levels of digital competence also report higher levels of motivation and learning progress. This is consistent with previous research that has demonstrated a positive association between digital competence and learning outcomes in flipped classrooms (Huang & Hew, 2018).

Lastly, the high internal consistency of the social skills scale (Cronbach's Alpha = 0.988) implies that the integration of MOOC-based flipped classrooms is effective in fostering social skills among freshmen. The strong inter-item correlations further support the notion that the scale measures the same underlying construct of social skills (George & Mallery, 2003).

The integration of MOOC-based flipped classrooms for digital competence development in freshmen appears to be effective across various skill categories. The results highlight the potential of this approach in enhancing students' general understanding of digital concepts, operational skills, creativity, information navigation, mobile device skills, and social skills. Additionally, the strong relationships between digital competence and motivation and learning progress underscore the importance of fostering digital competence for academic success. Future research should continue to explore the long-term effects of MOOC-based flipped classrooms on digital competence development and its impact on academic performance.

6. CONCLUSION

In summary, this study provides evidence that the integration of MOOC-based flipped classrooms is effective for digital competence development in freshmen across various skill categories. The findings indicate that students demonstrate a strong understanding of general digital concepts, operational skills, creativity, information navigation, mobile device skills, and social skills. Furthermore, the strong relationships between digital competence and motivation and learning progress suggest that fostering digital competence is essential for academic success.

Future Recommendations

Based on the findings and conclusions of this study, the following recommendations are suggested for future research and educational practice:

1. Longitudinal studies: Future research should employ longitudinal designs to assess the long-term effects of MOOC-based flipped classrooms on digital competence development and its impact on academic performance. This would provide valuable insights into the sustainability and efficacy of this approach over time.
2. Curriculum development: Educators and policymakers should consider incorporating MOOC-based flipped classrooms into the curriculum as a means to enhance digital competence among students. This could involve the development of specific courses or modules designed to target various skill categories, such as operational skills, creativity, information navigation, and social skills.
3. Diverse educational contexts: Further research should explore the effectiveness of MOOC-based flipped classrooms in different educational contexts, such as secondary education, vocational training, and professional development programs. This would provide a more comprehensive understanding of the potential benefits and limitations of this approach across various learning environments.
4. Customization and personalization: In order to optimize the effectiveness of MOOC-based flipped classrooms, future studies should investigate the potential of tailoring learning materials and instructional strategies to the individual needs and preferences of students. This could involve the development of adaptive learning systems or the use of learning analytics to inform personalized learning pathways.
5. Training and support: Educators should be provided with adequate training and support in the implementation of MOOC-based flipped classrooms. This includes the development of guidelines, best practices, and resources to facilitate the successful integration of this approach into teaching practice.
6. Technological infrastructure: Educational institutions should ensure that they have the necessary technological infrastructure to support MOOC-based flipped classrooms. This includes the provision of reliable internet access, suitable devices, and digital platforms for the delivery of learning materials and the facilitation of online collaboration.

By addressing these recommendations, future research and practice can continue to build on the promising findings of this study and contribute to the ongoing development of digital competence in higher education.

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