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FUTURISTIC RESEARCH GAPS IN LEARNING FOR VIRTUAL TEACHERS IN DEVELOPING COUNTRIES: OVERCOMING POST-PANDEMIC SHOCKS AND PRECEDING SOCIETY 5.0

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Abstract: This study focused on exploring and analyzing the potential research gaps in teaching and learning for virtual teachers in the digital era. It was exclusively related to the post-pandemic era in developing countries preceding Society 5.0. The main aim was to identify future trends and challenges in teaching and learning models in line with the characteristics of smart students. Additional objectives were to identify the possible future teaching and learning models, examine the spectrum of research gaps, and analyze the future trends in teaching related to the characteristics of smart students. The inquiry presented a qualitative inquiry. It combined a systematic and comprehensive literature review approach. It consisted of a comprehensive 12-syntax to explore the futuristic research gaps in virtual teaching. The study identified eight research gaps: Access and infrastructure, teacher training and professional development, pedagogical practices in virtual environments, inclusivity and equity, assessment and evaluation in virtual learning, digital citizenship and online safety, parent and community engagement, and policy and governance. Educators, policymakers, and researchers constructively contributed to the advancement of virtual teaching and learning accordingly. The results lead to more inclusive, equitable, and effective educational openings that fulfill students' needs, especially in the Indonesian context.

Keywords: Research gaps, virtual teaching, post-pandemic era, Society 5.0, smart students

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INTRODUCTION

1.1. Background

The world underwent a profound transformation with the outbreak of the COVID-19 pandemic, significantly impacting various sectors, particularly education. Educational institutions faced unprecedented challenges, prompting a swift shift towards virtual learning to ensure continuity in learning amidst lockdowns and social distancing measures (Brown & Jones, 2022). In developing countries, where educational infrastructure and technology adoption were not as advanced as in developed nations, this transition posed even greater challenges. Virtual teaching became a crucial tool for sustaining education during the pandemic. However, it still revealed substantial gaps in the preparedness of teachers to effectively navigate the virtual landscape.

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In the post-pandemic era, the effects of this sudden transformation linger, necessitating a deep understanding of the unique challenges faced by virtual teachers in developing countries. As the world moves towards the concept of Society 5.0 (Rossi, 2018), an envisioned human-centered society that blends physical and virtual realms through technologies like artificial intelligence, the Internet of Things, and advanced communication, it is therefore crucial to address the research gaps in learning for virtual teachers (Deguchi, Hirai, Matsuoka, Nakano, Oshima, Tai & Tani, 2020). This paper then focuses on exploring the challenges and opportunities for virtual teachers in the developing world, envisioning a futuristic approach to education that overcomes the post-pandemic shocks and aligns with the principles of Society 5.0 related to the Indonesian context.

1.2 Objectives

The objectives of this study are therefore to: (1) Identify Post-pandemic Shocks, i.e., investigate the challenges faced by virtual teachers in developing countries following the abrupt shift to remote learning during the COVID-19 pandemic; understand the impact on teachers' professional development, well-being, and pedagogical practices, (2) Explore Futuristic Research Gaps, i.e., analyze the current state of virtual teaching in developing countries and identify the research gaps that need to be addressed; empowering teachers in the context of advancing technologies and the principles of Society 5.0, (3) Propose Strategies for Overcoming Challenges, i.e., suggest innovative approaches and strategies help virtual teachers overcome the identified challenges; scrutinizing how emerging technologies, upskilling opportunities, and collaborative platforms can aid in their professional growth.

This study endeavors to shed light on the futuristic research gaps in learning for virtual teachers in developing countries, focusing on mitigating post-pandemic shocks and embracing the principles of Society 5.0. By addressing these gaps, we aspire to contribute to the enhancement of education systems in developing countries and to empower teachers in preparing the next generation for a technologically advanced and inclusive future.

1.3. The Conceptual Framework

This paper revolves around the intersection of virtual teaching, developing countries, post-pandemic shocks, and the principles of Society 5.0 (Smith, 2021; Selwyn, 2012; Vrasidas, Zembylas & Glass, 2022). Virtual teaching has become a significant mode of education delivery in the wake of the COVID-19 pandemic, especially in developing countries where traditional educational systems face disruption. Society 5.0, as a forward-looking concept, envisions a human-centered society that effectively blends physical and virtual realities. The framework aims to identify the challenges faced by virtual teachers in developing countries due to the sudden shift to online education during the pandemic and proposes strategies to align teaching practices with the principles of Society 5.0. By synthesizing existing literature on virtual teaching, educational technology, and Society

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5.0, this framework provides a foundation for understanding the research gaps and envisioning futuristic teaching and learning models, as highlighted by OECD (2019).

1.3.1 Possible Futuristic Teaching and Learning Models

The literature review in this regard explores possible futuristic teaching and learning models that can empower virtual teachers in developing countries. It examines emerging technologies, namely artificial intelligence, virtual reality, and augmented reality as well as their potential applications in education. It also needs to consider the integration of smart devices and the Internet of Things in educational settings and enable personalized and adaptive learning experiences. It is also related to the role of gamification and immersive learning approaches in engaging students and promoting active learning in virtual classrooms (McDiarmid & Zhao, 2023; Moorhouse, Wong & Li, 2023).

1.3.2 Spectrum of Research Gaps in Teaching and Learning in the Digital Era

A spectrum of research gaps in teaching and learning within the context of the digital era particularly focuses on developing countries. This is to investigate the challenges faced by virtual teachers, such as limited access to technology and the internet, inadequate digital literacy, and the need for specialized training in virtual pedagogy. It needs to examine the effectiveness of different virtual teaching methodologies, barriers to technology adoption in the educational landscape, and the impact of virtual learning on student outcomes and engagement. It also needs to address issues related to equity and inclusivity in virtual education by considering the disparities that may arise due to socioeconomic factors and geographical locations.

1.3.3 Future Trends in Teaching and Learning Models for the Post-pandemic Era in Developing Countries

It is relevant to project future trends in teaching and learning models for the post-pandemic era in developing countries. It needs to analyze the potential implications of Society 5.0 on education and explore how virtual teachers can leverage cutting-edge technologies to foster collaborative, creative, and innovative learning environments. It needs to consider the integration of data analytics and learning analytics to enhance personalized learning experiences and inform evidence-based decision-making for educational policymakers.

1.3.4 Spectrum and Characteristics of Smart Students for Society 5.0

It delves into the spectrum and characteristics of "smart students" in the context of Society 5.0. As technological advancements become integral to everyday life, smart students are expected to possess not only academic proficiency but also digital literacy, adaptability, problem-solving skills, and creativity. It needs to explore how virtual teachers can nurture these characteristics in students, encouraging them to become active participants in a technology-driven and socially responsible Society 5.0.

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This is the way to synthesize existing research on virtual teaching, digital learning, and Society 5.0 to identify research gaps and propose futuristic models that address the challenges faced by virtual teachers in developing countries developing smart students. By envisioning a future-oriented approach to education, this is the approach to the enhancement of teaching practices and preparing students to thrive in a digitally advanced and socially transformative Society 5.0.

2. RESEARCH DESIGN

The study utilizes a qualitative approach, i.e., a modification of the five steps of the Integrative Literature Review (ILR) and seven steps of the Comprehensive Literature Review (CLR). They are a valid all-inclusive review, consisting of a systematic and scientifically designed review of a defined literature base that employs the rigor of original research to limit potential outcome bias.

The first type of research elaborated was ILR, a kind of library research introduced by Onwuegbuzie and Frels (2015) and Williams (2018). The process follows five-phase steps consisting of design, conduct, analysis, structuring, and writing a report. It was closely related to the semi-structured review aiming at assessing, criticizing, and synthesizing the literature on the related research topic.

The second type of research particularized was CLR. It is a kind of literature research as introduced by Whittemore and Knafl (2005) and Snyder (2019). The process follows a seven-step approach. It includes defining the scope, planning the approach, searching the strategy for efficiency, managing the literature, reading-analyzing, benchmarking from other comparable works of literature, and assembling-writing the results. These steps are followed to assess, criticize, and synthesize related literature, enabling new-fangled and applicable theoretical frameworks and perspectives to emerge methodically.

Methodically, the processes and procedures of this study finally utilized an integrated 12-syntax approach, as follows:

1. Define the research questions and objectives of the study.
2. Conduct a preliminary search to identify relevant keywords and terms.
3. Perform a systematic literature review by searching academic databases using predetermined inclusion and exclusion criteria.
4. Extract and analyze data from the selected studies, focusing on the identified research gaps and future trends.
5. Perform a comprehensive literature review by conducting additional searches beyond the systematic review to ensure comprehensive coverage of the topic.
6. Analyze the findings from the comprehensive review and integrate them with the systematic review findings.
7. Identify and invite three experts in the field to provide their insights and expertise.
8. Conduct interviews or focus group discussions with the invited experts to gather additional perspectives.
9. Analyze the expert input and integrate it with the findings from the literature

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reviews.
10. Synthesize the findings and discuss their implications for teaching and learning practices in the digital era, particularly in developing countries context.
11. Provide recommendations for policymakers, practitioners, and researchers based on the identified research gaps and future trends.
12. Conclude the paper by summarizing the key findings, discussing limitations, and suggesting directions for future research.

Under this approach, the study then synthesized existing research results and expert perspectives to investigate the challenges faced by virtual teachers in developing countries following the abrupt shift to remote learning during the COVID-19 pandemic. It is also of interest to understand the impact on teachers' professional development, well-being, and pedagogical practices. Moreover, under this orientation, it is relevant to analyze the current state of virtual teaching in developing countries and identify the research gaps that need to be addressed to empower teachers in the context of advancing technologies and the principles of Society 5.0.

Correspondingly, the inquiry under this approach suggests innovative approaches and strategies to help virtual teachers overcome the identified potential challenges. In short, the help of this method will allow virtual teachers to examine how emerging technologies, upskilling opportunities, and collaborative platforms can aid in their professional growth. It was expected that these approaches facilitate an explanation of how relevant research will enhance learning experiences in the classroom for the benefit of both students and teachers.

3. RESULT AND DISCUSSION

After going through an inquiry following the developed and combined methodology, this study was able to initiate a conceptual breakthrough with several recommendations as follow-ups. Based on the structured studies that have been carried out, it is directed at filling the existing gaps. At least the previous description leads to exploring the following gaps, including: (1) The impact of technological advancements on teaching and learning practices in developing countries, (2) Challenges faced by virtual teachers in the post-pandemic era, (3) Effective strategies for virtual teacher training and professional development, (4) Access to digital resources and infrastructure in developing countries, (5) The role of virtual reality (VR) and augmented reality (AR) in teaching and learning, (6) Inclusivity and equity in virtual education for diverse student populations, and (7) Assessment and evaluation methods for virtual learning environments in developing countries.

Those gaps are tightly related to the initial focus and objectives that need to be comprehensively touched. In essence, the focus and aims of the study cover exploring and analyzing the potential research gaps in teaching and learning for virtual teachers in the digital era that are exclusively related to the post-pandemic era in developing countries preceding Society 5.0. The main aim was to identify future trends and challenges in teaching and learning models. This is in line with the characteristics of smart students and

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the additional objectives. That is to identify the possible future teaching and learning models, examine the spectrum of research gaps, and analyze the future trends in teaching related to the characteristics of smart students.

Having thoroughly conferred, the futuristic research gaps in teaching and learning for virtual teachers in the digital era related to the post-pandemic era in developing countries, including in the Indonesian context preceding Society 5.0, include the following areas (Fuegen, 2012, Timotheou, Miliou, Dimitriadis, Sobrino, Giannoutsou, Cachia, Monés, & Ioannou, 2023; Bergdahl & Nouri, 2021; Davis, 2020).

3.1 Access and Infrastructure

It covers investigating the availability and accessibility of digital infrastructure, including internet connectivity and technology devices, in developing countries to support virtual teaching and learning. Moreover, it is also relevant to explore the challenges faced by virtual teachers and students in accessing and effectively utilizing digital resources. Access and Infrastructure in the context of virtual teaching and learning in developing countries like Indonesia refers to the availability and accessibility of digital resources, including internet connectivity and technology devices, crucial for effective online education. It is therefore critical to cautiously note the following aspects.

3.2 Availability of Digital Infrastructure

In developing countries, ensuring that digital infrastructure is available is a key challenge. This includes having a reliable and widespread internet connection, access to electricity, and technology devices such as computers, tablets, and smartphones. Availability often varies significantly across regions within a country.

3.3 Accessibility of Digital Infrastructure

Accessibility focuses on making these digital resources within reach of the population. This involves ensuring affordability, especially for low-income individuals and families. Additionally, digital literacy and skills are essential to make these resources usable, and efforts must be made to bridge the digital divide.

3.4 Challenges in Indonesia's Context

3.4.1 Uneven Distribution

In essence, with uneven distribution in Indonesia, access to digital infrastructure is not uniform, with rural areas having limited internet connectivity and poorer access to technology devices. This creates a digital divide, disadvantaging students and teachers in remote regions. Affordability, as a consequence of high data, costs, and the price of technology devices can make virtual learning financially burdensome for many Indonesians, limiting their access to educational resources. Digital literacy is one crucial aspect as many students and teachers may lack the necessary digital literacy skills to

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effectively utilize online resources for education. Training and support are essential to bridge this gap. Besides, infrastructure availability and quality still exist. Even in areas with available access, the quality of connectivity may be inconsistent, leading to challenges in conducting virtual classes, accessing online materials, or participating in video conferencing ().

Respectively, on language barriers as Indonesia is a linguistically diverse country with numerous regional languages. The availability of digital resources and online content in various languages may be limited, hindering educational opportunities for non-Indonesian speakers. Content Relevance for virtual teachers and students may face challenges in finding digital resources and content that are aligned with their curriculum and educational needs. In addition, student engagement, especially in virtual learning can be less engaging and interactive compared to traditional classroom teaching. Teachers may find it challenging to keep students motivated and involved in the learning process.

Addressing these challenges in the Indonesian context and similar developing countries requires a multi-pronged approach. It includes government investment in digital infrastructure, affordability initiatives, digital literacy programs, and curriculum adaptation to the virtual learning environment. It is then critical to involve collaborations with private sector entities and other related stakeholders to ensure equitable access to digital resources and quality education for all.

3.4.2 Teacher Training and Professional Development

In terms of teacher training and professional development, examining effective strategies and approaches for training and upskilling virtual teachers in developing countries is vital. It is aimed to enhance their pedagogical and technological competencies. It includes identifying the gaps in current teacher training programs and exploring innovative approaches for continuous professional development.

The need for teacher training and professional development in the context of virtual teaching in developing countries is of paramount importance. First, it is related to the issue of “Bridging the Digital Divide.” In many developing countries, there is a significant digital divide that hampers both students' access to quality online education and teachers' ability to effectively deliver it. To overcome this divide, teachers need training to develop the necessary technological skills to facilitate virtual learning.

Second, it is related to “Enhancing Pedagogical Skills.” Virtual teaching requires different pedagogical strategies than traditional classroom teaching. Effective teacher training can help educators adapt their instructional methods, ensuring that virtual education is engaging, interactive, and conducive to student learning.

Third, it is related to “Addressing Post-Pandemic Challenges.” The COVID-19 pandemic accelerated the shift to online learning, catching many teachers unprepared. As the world transitions beyond the pandemic, it is crucial to equip teachers with the skills and strategies to excel in the post-pandemic educational landscape.

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Fourth, it is related to "Fostering Lifelong Learning." Teachers in developing countries must become lifelong learners themselves, continuously updating their knowledge and skills to meet the evolving demands of education in the digital age. Professional development programs can instill this culture of continuous learning.

Fifth, it is related to "Adapting to Society 5.0." The concept of Society 5.0 envisions a highly interconnected society driven by technology. Teachers need to be prepared to integrate emerging technologies and prepare students for this future. Professional development can help them align their teaching with the goals of Society 5.0.

It is then critical to identify gaps in current teacher training programs and explore innovative approaches for professional development. Teacher training and professional development are essential for improving the quality of virtual education in developing countries. They positively help teachers overcome challenges, adapt to technological advancements, and ensure that students receive a high-quality education, even in the face of post-pandemic disruptions and the evolution of Society 5.0.

3.4.3 Pedagogical Practices in Virtual Environments

Viewed from pedagogical practices in virtual environments, it is significant to explore effective pedagogical practices and instructional strategies for virtual teaching in developing countries. It also includes investigating how virtual teachers can adapt traditional teaching methods to engage and support students in remote learning environments. Moreover, it needs to examine the impact of virtual teaching on student engagement, motivation, and learning outcomes.

Exploring effective pedagogical practices and instructional strategies for virtual teaching in developing countries is of great importance (https://elearningindustry.com/distance-learning-pedagogy-developing-countries). This is supported by several reasons, as follows.

First on Equity in Education. Developing countries often face challenges related to educational access and quality. Virtual teaching can bridge this gap by providing opportunities for students in remote or underserved areas to access high-quality education. It's a cost-effective way to reach students who may not have access to traditional schools due to geographical or socioeconomic barriers.

Second on Adaptation of Traditional Methods. Traditional teaching methods, which have been tried and tested over time, can be adapted for virtual environments. However, it's crucial to adapt them effectively to ensure that the core pedagogical principles are not lost. For example, incorporating interactive online discussions, multimedia resources, and collaborative projects can emulate the dynamics of traditional classroom interactions. This adaptation is essential to engage students effectively.

Third is the Impact on Student Engagement. Student engagement is a critical factor in the learning process. In virtual teaching, the challenge lies in maintaining and enhancing this

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engagement. Effective pedagogical practices in virtual environments, such as using gamification, interactive quizzes, and discussion forums, can create an environment where students actively participate and remain interested in the subject matter. Furthermore, teachers should strive to provide timely feedback and personalized support to keep students motivated and engaged.

Fourth is Motivation. Motivation is a key driver of learning outcomes. In a virtual environment, students may face distractions and lack the immediate presence of a teacher. Therefore, it's crucial to employ pedagogical strategies that enhance motivation. This can be achieved by setting clear learning objectives, offering relevant and meaningful content, and designing assessments that encourage self-regulation and self-assessment.

Fifth is on the Learning Outcomes. The ultimate goal of any educational endeavor is to achieve positive learning outcomes. Evaluating the impact of virtual teaching on these outcomes is essential. Research and data collection can provide insights into whether students are achieving the expected learning goals in virtual environments. It's also important to assess whether they are acquiring not just knowledge but also critical thinking, problem-solving, and other higher-order skills.

Sixth is on Continuous Improvement. Virtual teaching in developing countries should not be viewed as a one-time solution but as an ongoing process. Regular evaluation and adaptation of pedagogical practices are essential. This means collecting data on student performance, feedback from students and teachers, and adjusting the teaching strategies accordingly to maximize effectiveness.

Seventh is on Resource Efficiency. Virtual teaching can make efficient use of limited resources in developing countries. By utilizing online platforms and open educational resources, it can be cost-effective and scalable, reaching a broader audience without the need for extensive infrastructure or physical facilities. Eight is on Global Competence. Preparing students in developing countries for the global economy is crucial. Virtual teaching can expose them to a more diverse range of perspectives, international content, and collaborative opportunities, fostering global competence.

In brief, exploring effective pedagogical practices and instructional strategies for virtual teaching in developing countries is essential for improving access, engagement, motivation, and learning outcomes. It also offers the opportunity to adapt and enhance traditional teaching methods, ultimately providing a pathway for students in these regions to acquire a quality education and contribute to their personal and societal development.

3.4.5 Inclusivity and Equity

It covers investigating the challenges and opportunities for promoting inclusivity and equity in virtual education in developing countries. It needs to examine the digital divide and its implications for marginalized populations, including students with disabilities, those from low-income backgrounds, and rural communities. Furthermore, it is relevant to identify strategies to ensure equal access and quality education for all learners.

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Investigating the challenges and opportunities for promoting inclusivity and equity in virtual education in developing countries is critical for several reasons (O'Dowd, 2023). Therefore, it is imperative to examine the digital divide and its implications for marginalized populations by cautiously noting several essential attributes.

3.4.6 Bridging the Digital Divide

The fact is that access to technology and the internet is not universal. The digital divide disproportionately affects marginalized populations in developing countries. Investigating this divide is essential to understand the extent of the problem. It implies that students without access to technology are excluded from virtual education, i.e., widening educational disparities. This affects students with disabilities, those from low-income backgrounds, and rural communities the most.

3.4.7 Ensuring Access for Students with Disabilities

The fact is that there are potential students with disabilities who often face unique barriers to accessing virtual education. Investigating these challenges is necessary to create an inclusive learning environment. It implies that failing to accommodate students with disabilities can lead to their exclusion from education, i.e., perpetuating inequalities. It's essential to identify and address barriers such as lack of assistive technology, inaccessible content, and limited teacher training in inclusive practices.

3.4.8 Supporting Low-Income Backgrounds

The fact is that there are families with limited financial resources, and they may struggle to provide the necessary technology for virtual learning. Investigating this issue is crucial to prevent educational inequalities. It implies that if these issues are not properly addressed, students from low-income backgrounds may fall behind, i.e., exacerbating the cycle of poverty. Strategies are needed to provide subsidized or low-cost devices, internet access, and digital literacy training.

3.4.9 Addressing Rural Education Disparities

The fact is that students in rural areas often face challenges related to poor connectivity, infrastructure, and teacher availability. Investigating these challenges is crucial to ensure equitable education. It implies that without access to quality education, rural students are at a disadvantage in terms of future opportunities. Strategies should include improving connectivity in remote areas, providing online and offline resources, and recruiting and training teachers for rural schools.

3.5 Strategies to Ensure Equal Access and Quality Education

First is the Government Initiatives. Developing countries should invest in infrastructure and initiatives that provide affordable or free internet access and devices to marginalized populations. This can include subsidized data plans, community centers with internet

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access, and distributing laptops or tablets to students. Second is on the Inclusive Curriculum and Content. It is critical to ensure that educational content is accessible to students with disabilities through the use of assistive technologies, closed captioning, and screen reader compatibility. Content should also reflect the diversity of the population to make it inclusive. Third is the Teacher Training. Educators should receive training in inclusive pedagogical practices, technology integration, and strategies for reaching students with diverse needs. This will enable them to adapt their teaching methods to cater to a variety of learners.

Fourth is Community Involvement. It is pertinent to engage communities in supporting education, including parents, local leaders, and NGOs. Community-based solutions can help address infrastructure issues, promote digital literacy, and provide a support system for students. Fifth is on Mixed-Mode Learning. It needs to implement a combination of online and offline learning methods to cater to students without consistent internet access. Offline resources such as printed materials or pre-recorded lessons can be distributed in remote areas. Sixth is the Assessment and Evaluation: It needs to regularly assess the impact of these strategies to ensure they are effectively promoting inclusivity and equity. Adjust as needed based on the data and feedback from marginalized populations.

Investigating the challenges and opportunities for promoting inclusivity and equity in virtual education in developing countries is essential to address the digital divide and ensure that all learners, regardless of their background, have equal access to quality education. Implementing these strategies can help bridge the gaps and create a more inclusive and equitable educational landscape.

3.5.1 Assessment and Evaluation in Virtual Environments

Viewed from an assessment and evaluation perspective in virtual environments, it needs to explore innovative and reliable methods for assessing and evaluating student learning in virtual environments in developing countries. It also needs to examine the effectiveness of various assessment approaches, such as online quizzes, projects, and collaborative activities. In addition, it is relevant to investigate strategies to ensure the integrity and fairness of assessments in remote settings.

Assessing and evaluating student learning in virtual environments in developing countries is a multifaceted challenge. Therefore, it necessitates innovative and reliable methods. Let us delve into the importance of these issues by providing the following comprehensive rationale.

3.5.2 Innovative and Reliable Assessment Methods

It is important to note that traditional assessment approaches, such as exams and written assignments, may not always translate effectively to virtual environments. It's essential to explore innovative methods that can accurately measure student learning in these contexts. Why is it so? Virtual environments should offer a unique opportunity to diversify assessment approaches. For example, online quizzes, multimedia projects, video

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presentations, and discussion forums can provide a more holistic view of a student's abilities. These methods not only assess knowledge but also critical thinking, problem-solving, and collaboration skills, which are essential for the modern workforce.

3.5.3 Evaluating the Effectiveness of Assessment Approaches

It is important to note that not all assessment approaches are equally effective in virtual settings. Their impact on learning outcomes may also vary. It is crucial to investigate and understand the efficacy of different assessment methods. Why is it so? Research and evaluation can help identify which methods work best for different subjects, age groups, and learning goals. For example, project-based assessments might be more suitable for assessing creativity and practical skills, while online quizzes can be effective for testing knowledge retention. Tailoring the assessment methods to specific learning objectives can optimize the learning process.

3.5.4 Ensuring Integrity and Fairness of Assessments

It is important to note that maintaining the integrity and fairness of assessments is critical to the credibility and equity of virtual education. It's vital to examine strategies to prevent cheating and ensure equal opportunities for all students. Why is it so? In virtual environments, there is an increased risk of academic dishonesty, such as plagiarism and unauthorized assistance during online exams. Strategies to address this issue may include using plagiarism detection tools, randomized question banks, open-book exams that require higher-order thinking, or alternative assessments that focus on the application of knowledge rather than recall.

To avoid misleading in the implementation operational stage, comprehensive strategies are needed. First is related to Rubrics and Clear Expectations. Provide students with clear rubrics and guidelines for assessments, ensuring they understand the criteria for success. This helps in setting expectations and promoting fairness. Second is related to Continuous Assessment. Implement continuous assessment methods, such as regular quizzes, discussion participation, and small projects, which reduce the pressure of high-stakes exams and allow for more authentic, ongoing feedback. Third is related to Peer Assessment. Incorporate peer assessment, where students evaluate each other's work. This encourages collaboration and provides diverse perspectives in the evaluation process.

Fourth is related to Formative Feedback. Ensure students receive formative feedback on their assessments. This not only aids in improvement but also helps to maintain academic integrity by allowing for self-regulation. Fifth is related to Proctored Exams: For high-stakes exams, consider using online proctoring services or secure exam platforms to monitor students during assessments and deter cheating. Sixth is related to Diverse Assessment Types. Employ a mix of assessment types to cater to different learning styles and abilities. This includes traditional exams, essays, group projects, oral presentations, and self-assessments. Seventh is related to Data Analysis. Continuously analyze data on student performance to identify patterns, areas for improvement, and the effectiveness of

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different assessment methods. This data-driven approach allows for ongoing refinement of assessment strategies.

In brief, exploring innovative and reliable assessment methods, evaluating their effectiveness, and ensuring the integrity and fairness of assessments in virtual environments in developing countries are pivotal steps in enhancing the quality of education. These efforts not only improve the evaluation of student learning but also contribute to the credibility and equity of virtual education, ultimately benefiting learners in these regions.

3.6 Digital Citizenship and Online Safety

Viewed from digital citizenship and online safety, it is crucial to examine the challenges and strategies for promoting digital citizenship and online safety among virtual teachers and students in developing countries. It also needs to investigate issues related to online privacy, cyberbullying, digital literacy, and responsible use of technology (https://www.commonsense.org/education/digital-citizenship). In addition, it needs to identify measures to enhance digital safety and ethical behavior in virtual learning environments.

Examining the challenges and strategies for promoting digital citizenship and online safety among virtual teachers and students in developing countries is a critical aspect of ensuring responsible and secure use of technology. Here's a brief overview of the key issues and potential solutions related to this important topic.

3.6.1 Digital Citizenship and Online Safety Challenges

First, pay attention to the issue of Limited Access to Technology. Many students and teachers in developing countries may not have access to the necessary digital devices and internet connectivity, hindering their participation in virtual learning.

Second, pay attention to the issue of Lack of Digital Literacy. A significant portion of the population may lack digital literacy skills, making them vulnerable to online risks and unaware of how to navigate online spaces safely.

Third, pay attention to the issue of Online Privacy Concerns. Privacy breaches and data misuse are prevalent due to inadequate regulations and awareness, making personal information vulnerable to exploitation.

Fourth, pay attention to Cyberbullying. Online harassment and cyberbullying can have severe emotional and psychological effects on students and teachers, and in some cases, it may go unaddressed.

3.6.2 Strategies to Promote Digital Citizenship and Online Safety

First, pay attention to the issue of Digital Literacy Training. Implement digital literacy

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programs for teachers and students to equip them with the skills needed to use technology safely and effectively.

Second, pay attention to the issue of Access to Technology. Efforts should be made to bridge the digital divide by providing affordable access to digital devices and internet connectivity, especially in remote areas.

Third, pay attention to the issue of Online Privacy Education. Raise awareness about online privacy, encouraging individuals to safeguard their personal information and adhere to best practices.

Fourth, pay attention to the issue of Cyberbullying Prevention. Create anti-cyberbullying campaigns and implement policies within virtual learning environments to report and address incidents promptly.

Fifth, pay attention to the issue of Safe Social Media Use. Educate students and teachers about responsible social media use, emphasizing the potential consequences of their online actions.

3.6.3 Enhancing Digital Safety and Ethical Behavior

First, pay attention to the issue of the Digital Citizenship Curriculum. Integrate digital citizenship and online safety into the formal education curriculum to instill responsible digital behavior from an early age.

Second, pay attention to the issue of Collaborative Efforts. Encourage collaboration between governments, educational institutions, NGOs, and technology companies to develop and enforce regulations and guidelines for online safety.

Third, pay attention to the issue of Secure Learning Platforms. Ensure that virtual learning platforms and tools used by teachers and students have robust security features and data protection measures in place.

Fourth, pay attention to the issue of Monitoring and Reporting Mechanisms. Implement mechanisms for reporting and addressing online safety concerns, such as cyberbullying, within virtual learning environments.

Fifth, Parent and Community Involvement. Engage parents and communities in promoting digital safety and ethical behavior to create a holistic approach to online safety.

In brief, promoting digital citizenship and online safety in developing countries among virtual teachers and students involves addressing issues like limited access, digital literacy, online privacy, and cyberbullying, while implementing strategies that empower individuals with the knowledge and tools to use technology responsibly and securely. Collaboration among various stakeholders is crucial to creating a safe and ethical online learning environment.

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3.7 Parent and Community Engagement

Viewed from parent and community engagement it is significant to investigate effective ways to involve parents and communities in supporting virtual teaching and learning in developing countries. It also needs to explore strategies for fostering collaboration between virtual teachers, parents, and community stakeholders to create a conducive learning environment (https://home.edweb.net/webinar/leadership20220331/). Plus, it needs to identify barriers and opportunities for parental involvement in remote education.

In the context of virtual teaching and learning in developing countries, involving parents and communities is of paramount importance for several reasons. Let us delve into the rationale and explanations for those issues.

1. Equity and Access: In many developing countries, there is a significant digital divide. Virtual teaching and learning can exacerbate existing educational inequalities if not managed properly. Engaging parents and communities is crucial to ensure that students, especially those in underserved areas, have access to the necessary technology and resources. Parents can play a role in advocating for improved access, and communities can mobilize resources to bridge the digital gap.
2. Support and Supervision: Parents play a vital role in supporting their children's virtual learning. They can help with technical issues, provide a conducive learning environment at home, and offer emotional support. However, many parents may not be familiar with virtual learning tools and methods. Therefore, it's essential to involve them in capacity-building programs, workshops, or informational sessions to empower them to better support their children's education.
3. Cultural Relevance: In many developing countries, the cultural and linguistic diversity of students can be quite significant. Engaging parents and communities is essential to ensure that virtual teaching and learning materials are culturally relevant and sensitive. Parents and community members can provide valuable insights into the specific needs of their children and can collaborate with educators to adapt and create content that is culturally appropriate.
4. Community Resources: Communities often have resources that can be leveraged to support virtual education. These resources can include community centers, local libraries, or individuals with expertise in various subjects. Engaging with communities can help identify and harness these resources to enhance the virtual learning experience.
5. Collaboration and Communication: Effective communication between virtual teachers, parents, and community stakeholders is crucial. Teachers can provide insights into students' progress and areas needing improvement, while parents and communities can share their observations and concerns. Collaboration can help identify strategies to improve virtual teaching and learning, making it a collective effort rather than the sole responsibility of educators.
6. Barriers to Parental Involvement: Barriers to parental involvement in virtual education are significant in developing countries. These barriers can include limited access to the internet, lack of digital literacy, and parents' work schedules, among others. Identifying these barriers is crucial to developing strategies to mitigate them.

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For example, schools can provide internet access in the community, offer digital literacy training for parents, or schedule virtual classes at times that are convenient for working parents.

7. Opportunities for Engagement: Developing countries also present unique opportunities for parental involvement. Many parents in these regions are deeply invested in their children's education and are willing to engage actively. Leveraging this enthusiasm and building on local community strengths can foster a strong partnership between schools, parents, and communities.

In brief, involving parents and communities in supporting virtual teaching and learning in developing countries is not only a matter of necessity but also a way to harness local resources, address educational disparities, and foster a sense of collective responsibility for the success of the education system. By identifying and addressing the barriers and opportunities for parental involvement, educational institutions can create a more inclusive and conducive learning environment, ultimately benefiting the students and the entire community.

3.8 Policy and Governance

Viewed from a policy and governance perspective it needs to examine the policy frameworks and governance structures necessary to support virtual teaching and learning in developing countries. It needs to investigate the role of government agencies, educational institutions, and international organizations in formulating and implementing policies that facilitate effective virtual education, including identifying policy gaps and areas for improvement.

The rationale for examining the policy frameworks and governance structures necessary to support virtual teaching and learning in developing countries is rooted in the increasing importance of technology in education. As digital technologies continue to evolve and reshape the way education is delivered globally, it is imperative to understand how policies and governance structures can be tailored to suit the unique needs and challenges of developing nations (https://www.oecd.org/derec/sweden/Rapport-Education-developing-countries.pdf).

The following points justify the need for this examination.

1. Educational Inclusivity: Virtual education has the potential to bridge the educational gap in developing countries, providing access to quality education for underserved populations. However, this potential can only be realized through well-crafted policies and governance structures.
2. Economic Development: A well-educated workforce is crucial for the economic development of any nation. Virtual education can be a cost-effective way to upskill the workforce, making it essential for policymakers to create an enabling environment.
3. Global Competitiveness: In an increasingly interconnected world, countries need a skilled and adaptable workforce to remain competitive. Sound policies and

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governance structures are vital for ensuring that the education system aligns with the demands of the global economy.

4. Rapid Technological Advancements: Technology in education is evolving rapidly. To harness its full potential, it is necessary to continually adapt and update policies and governance structures to keep pace with these changes.

The explanation of the above rationale is related to the following essential factors.

1. Inclusivity: Developing countries often have limited access to quality education due to factors like insufficient infrastructure, remote locations, and socioeconomic disparities. Virtual education can overcome some of these barriers by providing online courses and resources. However, to ensure inclusivity, policies must address issues like internet access, affordability of devices, and digital literacy. Governance structures are necessary to ensure equitable distribution of resources and monitor the implementation of these policies.
2. Economic Development: Education is a key driver of economic growth. Virtual education can offer cost-effective solutions by reducing the need for physical infrastructure and materials. However, policies need to address issues like funding, quality assurance, and recognition of virtual degrees to ensure that learners receive a valuable education. Governance structures are essential to oversee accreditation, certification, and program quality.
3. Global Competitiveness: A well-educated population is a source of competitive advantage for nations. Policies must align educational offerings with the skills and knowledge required for the global job market. Governance structures play a role in coordinating efforts across government agencies, educational institutions, and international organizations to ensure that the education system is responsive to these demands.
4. Rapid Technological Advancements: The technological landscape is constantly changing, influencing how education is delivered and received. Policies and governance structures need to be adaptable and forward-thinking to embrace emerging technologies and teaching methods. This requires continuous assessment, research, and collaboration with international organizations to share best practices and leverage resources.

Examining the policy frameworks and governance structures for virtual teaching and learning in developing countries is essential to unlock the potential of digital education, address the unique challenges faced by these nations, and ensure that their education systems remain relevant and competitive in a rapidly changing world. This examination will help identify policy gaps and areas for improvement, leading to more effective and inclusive virtual education systems.

By thoroughly addressing these futuristic research gaps, educators, policymakers, and researchers can then contribute to the advancement of virtual teaching and learning practices in the post-pandemic era in developing countries. It will lead to more inclusive, equitable, and effective educational opportunities for students.

CONCLUSION

This study conclusively sheds light on the futuristic research gaps in learning for virtual teachers in developing countries, with a focus on overcoming post-pandemic shocks and aligning with the principles of Society 5.0. The literature review identified challenges faced by virtual teachers in the digital era, emphasizing limited access to technology, the need for specialized training, and concerns about equity and inclusivity. It explored possible futuristic teaching and learning models, leveraging emerging technologies to enhance education delivery.

Progressing towards Society 5.0, the role of virtual teachers becomes increasingly crucial in preparing smart students who possess digital literacy, adaptability, and problem-solving skills. To meet this demand, strategies should be devised to empower teachers with innovative tools, data analytics, and collaborative platforms to foster a dynamic learning environment (https://www.strongmind.com/empowering-teachers-with-data-driven-dashboards/)

Overall, this study can highlight the significance of addressing research gaps to strengthen virtual teaching practices and bridge the digital divide in developing countries (Lestiyanawati, 2020). By embracing futuristic approaches and capitalizing on technological advancements, we can envision an inclusive and transformative education landscape that benefits students, teachers, and society as a whole. As we move forward, it is essential to prioritize investment in teacher professional development, equitable access to technology, and sustainable educational policies to ensure a promising future for virtual education in developing countries.

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