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Article

**Readiness in Education 4.0: An Overview in the Context of Basic Education**

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**Abstract:** This analysis synthesizes data from seven tables, providing a comprehensive overview of the current state of educational practices, resources, and challenges. It begins by delineating the distribution of academic ranks among educators, highlighting a significant focus on special education. The educational attainment of these professionals predominantly features bachelor's degrees, indicating a foundation in undergraduate education. The evaluation of teacher readiness suggests an evolving competence in leveraging technology for educational purposes, yet it reveals variability in preparedness across different aspects of digital integration. Teaching and learning practices are increasingly embracing innovative and participatory approaches, utilizing digital tools to enhance student engagement and learning outcomes. However, the exploration of infrastructure requirements and research initiatives unveils critical shortcomings, particularly in digital infrastructure and support for research activities. The culmination of these findings in the identification of prevalent issues and concerns underscores the urgent need for enhanced digital resources, reliable internet connectivity, and comprehensive training and support for educators. This analysis underscores the complexities of integrating technology into education and the critical areas requiring attention to ensure the advancement and effectiveness of teaching and learning environments.

**Keywords:** Education 4.0, teaching readiness, teaching and learning process, research initiatives

**Introduction**

Teachers Education 4.0 is a response to the rapid advancements in technology and the evolving demands of the 21st-century workplace and it represents a significant shift from traditional teaching methods to a more integrated and technology-driven approach (Teo et al., 2021; Himmametoglu et al., 2020). Education 4.0 emphasizes personalized learning, the use of digital platforms, and the integration of artificial intelligence, robotics, and the Internet of Things (IoT) into the curriculum (Rane et al., 2023). This approach encourages critical



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thinking, creativity, and the ability to adapt to new technologies and processes.

The importance of Education 4.0 in the 21st-century education system cannot be overstated (Giesenbauer & Muller-Christ, 2020). It prepares students for future job markets that demand flexibility, innovation, and digital literacy. Incorporating technologies like AI and data analytics, Education 4.0 fosters a learning environment that is more engaging, interactive, and tailored to individual learning styles and needs (Asad & Malik, 2023). This forward-thinking approach ensures that learners are not just consumers of information but active participants in their educational journey, equipped with the skills necessary to navigate the complexities of the modern world (Chaker & Damak, 2024).

According to Alakrash & Razak (2020) the success of Education 4.0 heavily relies on teachers' readiness to adopt and effectively integrate these new technologies and methodologies into their teaching. Teachers are required to upskill and adapt to these changes, moving away from traditional teaching roles to become facilitators of learning (Padmaja & Mukul, 2021). This transition challenges teachers to not only be proficient in new technologies but also to foster an environment that promotes critical thinking, problem-solving, and lifelong learning (Gonzales-Perez & Ramirez-Montoya, 2022). The transition to Education 4.0 represents a significant shift in the educational landscape, requiring educators to adapt to new roles, methodologies, and technologies (Goh & Abdul-Wahab, 2020). While this transition poses challenges, particularly in terms of upskilling and adapting to new pedagogical approaches, it also offers substantial benefits by enhancing the learning experience and preparing students for the future. Success in this new era of education relies heavily on the readiness and willingness of educators to embrace change and innovate in their teaching practices. As such, educational institutions and policymakers must support educators through this transition, providing the necessary resources, training, and support to facilitate the integration of Education 4.0 into the classroom (Costan et al, 2021).

Caputo et al. (2019) emphasized that teachers' readiness is crucial for ensuring quality education and learning in the context of Education 4.0. It involves not only the mastery of digital tools and platforms but also a pedagogical shift towards more collaborative and student-centered learning approaches. Teachers must be prepared to design and deliver content in ways that leverage technology to enhance learning outcomes (McKnight et al., 2016). Additionally, their readiness impacts their ability to personalize learning, assess student progress in real-time, and provide feedback that supports individual learning paths.

Despite the potential benefits of Education 4.0, there are significant research gaps in understanding the extent of teachers' readiness for this new educational paradigm. Key areas of concern

include the adequacy of teacher training programs, the availability of necessary infrastructure, and the support for ongoing professional development. Additionally, there is a need for more comprehensive research programs and initiatives that explore the impact of teachers' readiness on the quality of teaching and learning in an Education 4.0 context.

Addressing these research gaps requires a multifaceted approach. Future research should focus on developing comprehensive frameworks for teacher training and professional development that are aligned with the demands of Education 4.0. This includes exploring innovative pedagogical strategies, effective use of technology in the classroom, and ways to enhance teachers' digital literacy. Moreover, there is a need for studies that assess the impact of infrastructure availability on teachers' ability to implement Education 4.0 strategies effectively. Such research can provide valuable insights into how educational systems worldwide can evolve to meet the challenges and opportunities presented by the fourth industrial revolution

## Methodology

This research utilized the Quantitative Research Design. The quantitative aspect of the study collected data on the teacher's readiness on the aspects of education 4.0. Quantitative research methodologies focus on objectivity, maintaining control, and achieving precise measurements. In terms of methodology, these approaches rely on deductive frameworks aimed at either disproving or bolstering evidence supporting specific theories and hypotheses. The respondents of this study were the teachers in the identified public schools. This study employed purposive sampling to select locations that met specific criteria related to inclusive education. The sampling strategy involved the geographic location to capture the regional nuance. The study sought to gather in-depth and targeted information relevant to the research objectives by selecting schools on predetermined criteria.

## Results and Discussion

Table 1. Academic Rank

Present Position	Frequency	Percentage
Master Teacher I	1	2.70
SPED Teacher	15	40.54
Teacher I	6	16.22
Teacher II	6	16.22
Teacher III	9	24.32
Total	37	100

The data presented in Table 1 outlines the distribution of academic ranks among a total of 37 educational professionals. The ranks range from Master Teacher I, with the least representation at only one individual, accounting for

2.70% of the total, to SPED (Special Education) Teacher, which has the highest representation at 15 individuals or 40.54% of the total. This indicates a significant emphasis on special education within this group. Teacher I and Teacher II ranks are equally represented, each with 6 individuals making up 16.22% of the total, suggesting a balanced distribution in these early career stages. Teacher III, a more advanced rank, is held by 9 individuals, representing 24.32% of the total, indicating a substantial presence of more experienced educators within this cohort. Overall, the data reflect a diverse range of academic ranks, with a particular focus on special education, an even spread among early career ranks, and a noteworthy portion of more seasoned Teacher III professionals.

Table 2. Highest Educational Attainment

Educational Attainment	Frequency	Percentage
Bachelor's Degree	29	78.38
Master's Degree	8	21.62
Total	37	100

The data in Table 2 provides insights into the highest educational attainment of a group of 37 individuals, presumably educators based on the context. The majority, with 29 individuals or 78.38%, hold a Bachelor's Degree, signifying that the bulk of this group has completed undergraduate level education as their highest form of academic achievement. On the other hand, a smaller yet significant portion, comprising 8 individuals or 21.62%, have attained a Master's Degree, indicating advanced postgraduate education among nearly a quarter of the group. This distribution suggests that while the foundation of the group's academic qualifications rests predominantly on undergraduate education, there is also a substantial commitment to furthering education through graduate studies. The presence of both Bachelor's and Master's degree holders highlights a diverse range of educational backgrounds, which could contribute to varied perspectives and expertise within their professional context.

Table 3. Teacher Readiness

Teacher Readiness	Mean
Am I technologically literate	3.37
Am I skillful in the use of learning management systems, google classroom, and online class modality	3.68
Accept the vital role of technology in the 21st century and beyond	3.89
Integrate digital technology in teaching and learning	3.89
Attend seminars and conferences to enhance my technological and pedagogical skills	4.05
Experiment new approaches using technology	3.73
lead in the development of innovative materials	3.51
Collaborate and build partnerships from other schools	3.57

Table 3 presents data on teacher readiness across various dimensions of technological and pedagogical proficiency, measured on a scale where the mean scores indicate the average self-assessment of a group of educators in each area. The data suggests a generally high level of

readiness among the educators, with particular strengths in certain areas. The highest mean score, at 4.05, is seen in their commitment to attend seminars and conferences to enhance technological and pedagogical skills, highlighting a strong dedication to continuous professional development. Close behind, the acceptance of the vital role of technology in the 21st century and the integration of digital technology in teaching and learning both share a mean score of 3.89, indicating a robust embrace of digital tools and methodologies in the educational process. The readiness to experiment with new approaches using technology, as indicated by a mean score of 3.73, along with the ability to lead in the development of innovative materials at 3.51, and to collaborate and build partnerships with other schools at 3.57, further emphasize a proactive and collaborative approach towards enhancing education with technology. The lower, yet still positive, mean scores in technological literacy (3.37) and skillfulness in using learning management systems, Google Classroom, and online class modalities (3.68) suggest areas where there is room for growth, despite an overall competence in these areas. Overall, the data reflects a forward-thinking and adaptable group of educators who are not only aware of the importance of technology in education but are also actively seeking to improve their skills and methodologies. Their readiness to learn and adopt new technologies, collaborate with peers, and innovate in their teaching practices positions them well to meet the challenges and opportunities of educating in the 21st century and beyond.

Table 4. Teaching Learning Practices

Teaching and Learning Practices	Mean
Use the following strategies in the delivery of instruction: individualized teaching (3.3) gamification and simulation (3.97) problem and inquiry-based teaching and learning (3.54) augmented and virtual reality (4.30)	3.78
Boost students' creativity through digital enablers	3.57
Use technology-based assessment tools (ex. Kahoot, Quizlet, etc.)	3.38
Develop 21st-century skills (ex. problem solving, collaboration, reflection, critical thinking, communication)	3.68
Teach digital citizenship (technology ethics, social, ethical, and legal responsibilities in the utilization of technological tools and resources, etc.)	3.51
Use individualized modular instructional materials	3.76
expose students to more participatory learning through field experiences	4.05
accommodate multiple learning styles through flexible assignments	3.95
TOTAL	3.72

Table 4 presents an overview of teaching and learning practices through the lens of mean scores, indicating the extent to which various educational strategies and tools are utilized, with a total average score of 3.72. Notably, augmented and virtual reality techniques stand out with the highest mean score of 4.30, suggesting a significant embrace of cutting-edge technology in education. This is followed closely by

strategies that promote participatory learning through field experiences, with a score of 4.05, highlighting the value placed on experiential learning. The use of gamification and simulation techniques also scores highly at 3.97, reflecting the increasing adoption of engaging and interactive methods to enhance learning.

The practices aimed at accommodating multiple learning styles through flexible assignments receive a strong endorsement as well, with a mean score of 3.95, emphasizing the importance of adaptability and personalized learning. Boosting students' creativity through digital enablers and developing 21st-century skills such as problem-solving, collaboration, and critical thinking are also key components of contemporary teaching strategies, with scores of 3.57 and 3.68, respectively. On the other end, the use of technology-based assessment tools like Kahoot and Quizlet, while still positive, has a lower mean score of 3.38, indicating room for growth in this area. Similarly, teaching digital citizenship a crucial aspect of modern education has a mean score of 3.51, suggesting a moderate level of integration. Overall, the data reflect a strong inclination towards innovative and participatory teaching and learning practices that leverage technology, underscore the importance of developing critical 21st-century skills, and acknowledge the diverse needs and learning styles of students. The emphasis on experiential learning and the strategic use of digital tools and resources highlights a progressive approach to education that aims to prepare students effectively for future challenges.

Table 5. Infrastructure Requirements

Infrastructure Requirements	Mean
Has an office that takes charge of the ICT needs for teachers and learners	3.46
Has a stable internet connection which is accessible both for teachers and students	3.14
has available teaching and learning spaces that provide greater opportunity for collaboration	3.66
Has digital infrastructure which provides open access to the repository of information and scientific data	3.35
Has technology that provides access to blogs, vlogs, wikis, google classroom, Edmodo, and other related sites and reference databases (e.g., Google Scholar, Ebsco Host, LISA, etc.)	3.11
Has a computer laboratory with internet connection in which students can watch educational videos and collaborate with other students and other schools	2.95
has remote and virtual laboratories for learners	2.57
TOTAL	3.18

Table 5 outlines the infrastructure requirements for an educational setting, averaging a mean score of 3.18 across various elements, which indicates a moderate level of infrastructure support for technology-enhanced learning. The highest-rated requirement, with a mean of 3.66, is having available teaching and learning spaces designed to facilitate greater collaboration among participants. This suggests a strong appreciation for environments that promote interactive and cooperative learning experiences. The presence of an office dedicated to handling the ICT needs for teachers and learners scores a mean of



3.46, highlighting the importance of institutional support in managing and optimizing the use of information and communication technologies in education. Similarly, the availability of digital infrastructure that provides open access to a repository of information and scientific data receives a score of 3.35, reflecting the value placed on easy access to knowledge resources. Internet connectivity, a fundamental requirement for accessing digital educational resources, presents a varied picture. While having a stable internet connection accessible to both teachers and students scores a mean of 3.14, the provision of a computer laboratory with an internet connection for educational collaboration scores slightly lower at 2.95. This might indicate challenges in ensuring consistent and high-quality internet access for all users. The infrastructure for accessing diverse online learning platforms and resources, such as blogs, vlogs, wikis, and academic databases, has a mean score of 3.11, underscoring the necessity for tools that support a wide range of teaching and learning activities. However, the data also reveal areas needing significant improvement, notably in providing remote and virtual laboratories for learners, which scores the lowest at 2.57. This indicates that while there is a foundation for technology integration in education, there remains considerable room for enhancement, particularly in creating more immersive and interactive online learning environments. Overall, the data reflect a transitioning educational landscape where the importance of collaborative spaces, digital resources, and ICT support is recognized, yet the full potential of these elements is not yet fully realized, particularly in areas critical for facilitating advanced digital learning experiences such as virtual laboratories.

Table 6. Research Programs and Initiatives

Research Programs and Initiatives	Mean
Research undertakings are geared towards innovations	3.05
There is an allocated budget for research activities	2.72
Research outputs are used for policy recommendations	2.89
Some research outputs generate new models for teaching and assessment	2.97
There is multidisciplinary collaboration in the conduct of research	2.95
There is a local partnership in research projects	2.86
International partnership is evident in the conduct of research activities	2.65
There is a program for action research mentoring and coaching	2.86
TOTAL	2.89

Table 6 focuses on research programs and initiatives, revealing an overall mean score of 2.89, which indicates a moderate engagement with research activities aimed at enhancing educational practices and outcomes. The highest score, although modest at 3.05, is attributed to research undertakings focused on innovations, suggesting an inclination towards research that drives new methods and technologies in education. The allocated budget for research activities is the most

significant area of concern, scoring the lowest at 2.72, indicating limitations in financial support for research endeavors. Research outputs contributing to policy recommendations and the generation of new models for teaching and assessment are slightly more positively viewed, with scores of 2.89 and 2.97 respectively, hinting at the practical impact of research on educational strategies and policies. The scores for multidisciplinary collaboration in research, local partnership in research projects, and the program for action research mentoring and coaching are closely aligned, ranging from 2.86 to 2.95, reflecting a moderate level of collaborative and supportive research culture. However, international partnerships in research activities score the lowest after the budget, at 2.65, pointing out a notable gap in global collaboration which could otherwise enhance the quality and impact of research. This data collectively suggests a landscape where educational research is valued and has potential impact, yet is hampered by financial constraints and underdeveloped international collaborations, signaling areas for strategic improvement to foster a more robust research culture within the educational sector.

Table 7. Issues and Concerns

Issues and Concerns	Frequency	Percentage
Lack of ICT resources	23	62%
Facilities are not conducive for action research	13	35%
Internet connection is intermittent	21	57%
Cell sites and internet signal is slow	17	46%
Facilities are not equipped with advance technology	16	43%
Computers are slow and not applicable in the current set-up	18	49%
Lack of specialists in doing action research	20	54%
Lack of training in relation to new trends of computer	20	54%
School has no internet connection	10	27%
Not all Classrooms have computers and internet	32	86%

Table 7 illuminates' significant issues and concerns within an educational setting, primarily centered around the deficiency of digital infrastructure and resources. The data reveal that a substantial majority (86%) of respondent's face challenges due to the lack of computers and internet access in classrooms, highlighting a critical gap in essential technology resources necessary for modern education. Furthermore, issues such as the scarcity of ICT resources (62%), intermittent internet connectivity (57%), and a notable deficiency in both specialists for action research and training on new computer technology trends (each at 54%) underscore the considerable barriers to integrating digital solutions and conducting effective research. The report of slow computers and inadequate internet speeds, along with a lack of advanced technological facilities, further complicates the situation. Collectively, these concerns underscore an urgent need for investment in digital infrastructure, advanced technology, and professional



development to foster environments conducive to learning and research that meet contemporary educational standards.

Findings illustrates the distribution of academic ranks among educators, which outlines the key issues and concerns regarding digital infrastructure in education, a comprehensive narrative unfolds. The progression from the initial tables shows a significant emphasis on special education, a predominant attainment of bachelor's degrees over master's degrees among educators, and varying levels of teacher readiness in integrating technology into the curriculum. Teaching and learning practices highlight a forward-thinking approach, emphasizing digital tools and participatory learning. However, as we move to infrastructure requirements and research programs, the challenges become apparent, with issues such as inadequate digital infrastructure and limited research funding coming to light. Finally, challenges revealing significant gaps in ICT resources, internet connectivity, and the availability of advanced technology, alongside a lack of training and specialists in action research. This journey from educator qualifications and readiness through to the infrastructural and institutional challenges they face paints a picture of an education system striving to modernize and overcome significant hurdles in digital integration and resource allocation.

## Conclusion

The comprehensive analysis reveals a multifaceted view of the educational landscape, highlighting both its strengths and areas requiring urgent attention. From the diversity in academic ranks and educational attainments of educators to the progressive adoption of digital tools and innovative teaching practices, the data reflects a sector poised for growth and adaptation. However, the underlying challenges of inadequate digital infrastructure, insufficient resources, and the need for further training and research support cast a shadow over these advancements. The critical issues of accessibility to technology, reliable internet connections, and the development of a conducive environment for action research underscore the gap between current practices and the ideal state of educational readiness for the 21st century. Addressing these concerns is imperative for bridging the divide, ensuring educators and students alike can fully harness the potential of digital technologies for enhanced learning and teaching experiences. The data, therefore, calls for a concerted effort from stakeholders at all levels to invest in technological infrastructure, professional development, and research initiatives that align with the demands of contemporary and future educational landscapes.

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