International Journal of Social Learning
April 2025, Vol. 5 (2), 354-372
e-ISSN 2774-4426 and p-ISSN 2774-8359
DOI: https://doi.org/10.47134/ijsl.v5i2.373

The Challenge of Madrasah in Facing the VUCA Era (The Readiness of Islamic Madrasah Education System in Facing Digital Era)

Supa'at[1*], Muh Misbahul Munir[2], Fitria Noor Lailatur Rizqi[3]

[1,2]*Institut Agama Islam Negeri Kudus, Indonesia*
[3]*Islamic Middle School of Ibtidaul Falah, Indonesia*

*e-mail: supaat@iainkudus.ac.id

ABSTRACT

In the rising of VUCA (Volatility, Uncertainty, Complexity, Ambiguity) era characterized by rapid change and uncertainty, the education system faces major challenges. In Indonesia, educational institutions, including Islamic school, must adapt policies and strategies to remain relevant and effective. This research focuses on the Islamic senior high schools (Madrasah Aliyah /MA) in facing the digital era by exploring the readiness of the madrasah education system in overcoming the VUCA era challenges. This research uses qualitative approach with descriptive method and purposive sampling technique. The research has been conducted at MAN 1 Kudus, MAN 2 Kudus, and MA NU Banat. Subject of this research were the headmasters, stakeholders, teachers, and students. Data collection techniques include interviews, observation, and documentation. The data were then analyzed using triangulation. The result revealed that those schools were ready to face the digital challenge in terms of human resources, material, method and facilities. This research is expected to provide insight into curriculum adaptation, use of technology, and strengthening student character as an effort to achieve the vision of Indonesian education.

***Keywords*:**

VUCA Era; Madrasah Aliyah; Educational Technology.

ABSTRAK

Pada kemunculan era VUCA (Volatility, Uncertainty, Complexity, Ambiguity) yang ditandai dengan perubahan yang cepat dan ketidakpastian, sistem pendidikan menghadapi tantangan besar. Di Indonesia, lembaga pendidikan, termasuk sekolah Islam, harus menyesuaikan kebijakan dan strategi agar

Submitted: 2024-11-06; Accepted: 2025-04-09; Published: 2025-04-28
***Corresponding author:** supaat@iainkudus.ac.id

tetap relevan dan efektif. Penelitian ini berfokus pada Madrasah Aliyah (MA) dalam menghadapi era digital dengan mengeksplorasi kesiapan sistem pendidikan madrasah dalam mengatasi tantangan era VUCA. Penelitian ini menggunakan pendekatan kualitatif dengan metode deskriptif dan teknik purposive sampling. Penelitian telah dilakukan di MAN 1 Kudus, MAN 2 Kudus, dan MA NU Banat. Subjek penelitian ini adalah kepala sekolah, pemangku kepentingan, guru, dan siswa. Teknik pengumpulan data meliputi wawancara, observasi, dan dokumentasi. Data kemudian dianalisis menggunakan triangulasi. Hasil penelitian menunjukkan bahwa sekolah-sekolah tersebut siap menghadapi tantangan digital dari segi sumber daya manusia, materi, metode, dan fasilitas. Penelitian ini diharapkan dapat memberikan wawasan tentang adaptasi kurikulum, penggunaan teknologi, dan penguatan karakter siswa sebagai upaya untuk mencapai visi pendidikan Indonesia.

***Kata kunci*:**

Era VUCA; Madrasah Aliyah; Teknologi Pendidikan.

1. Introduction

VUCA seems to accurately describe the Fourth Industrial Revolution in which machine intelligence and more broadly, technology are transforming almost every field of human endeavor (LeBlanc, 2018). The world is currently experiencing an era marked by numerous changes and revolutions that often lead to significant disruptions due to the rapid and increasingly frequent nature of these transformations. The primary force propelling this era of change is the rapid advancement of technology, which has the potential to alter many aspects of our lives. (Santoso, Purnomo, & Herman, 2020). Educational institutions, regardless of their level or type, must adapt to the evolving demands of the VUCA era, characterized by Volatility, Uncertainty, Complexity, and Ambiguity. This VUCA environment presents unpredictable and rapidly changing conditions that can lead to heightened anxiety. (Hendrarso, 2020). In the wake of profound social changes, which have been accelerated due to a global pandemic, educators reconsider the role and goals of education, and subsequently, how its pragmatic expression should look like in a VUCA-world (Sarid & Levanon, 2023).

Volatility refers to a state characterized by uncertainty and a heightened sensitivity to changes. Uncertainty itself denotes a situation rife with unpredictability, marked by unexpected events that could occur at any moment. Complexity describes a condition filled with intricate elements, while ambiguity reflects a scenario where there is confusion regarding the determination of a clear direction. (Aribowo & Wirapraja, 2018). Current educational practices in Indonesia have also experienced developments in line with the advancement of IT technology (Maskanah & Lusiana, 2021). In light of these changes, it is essential for schools and madrasahs to adapt to the demands of our time. As vital instruments of modern society, contemporary education systems and practices must evolve into effective tools that assist society in navigating this era of swift transformation. (Ani, Lumanauw, & Tampenawas, 2021).

The World Economic Forum (WEF), during its session on the "21st Century Education Framework," outlined 16 essential skills that every student should develop to thrive in a competitive global landscape. These skills are categorized into three main groups: (1) foundational literacies, (2) competencies, and (3) character qualities. Foundational literacies encompass the core skills necessary for students to navigate daily tasks successfully. These include: (1) Literacy, (2) Numeracy, (3) Scientific Literacy, (4) ICT (Information and Communication Technology) Literacy, (5) Financial Literacy, and (6) Cultural and Civic Literacy. Competencies refer to the skills that enable children to face and address complex challenges. This group includes: (7) Critical Thinking and Problem-Solving, (8) Creativity, (9) Communication, and (10) Collaboration. Lastly, character qualities pertain to personal attributes that contribute to a child's overall development. These qualities include: (11) Curiosity, (12) Initiative, (13) Persistence (or Grit), (14) Adaptability, (15) Leadership, and (16) Social and Cultural Awareness. (Hermananis, 2021). The higher education curricula can now apply more specifically, any of the three dimensions areas of essential hard skill for student in VUCA era and understand the conditions under which a particular dimensions area is important for students to understand the changes caused by the VUCA and adjust the hard skills possessed by these changes (Andri, Lubis, Sari, & Chyntia, 2023).

Another initiative known as the "Partnership for 21st Century Skills" outlines six essential competencies or skills that individuals should possess to thrive in the 21st century. These include: (1) Critical thinking and problem-solving, (2) Communication and collaboration skills, (3) Creativity and innovation, (4) Information and communication technology literacy, (5) Contextual learning skills, and (6) Information and media literacy skills. (Ishak Abdullah in Hapudin, 2022). According to Widayat (2018), Education in the 21st Century is education that integrates knowledge, skills and attitudes, as well as mastery of Information and Communication Technology (ICT). The development of these skills can be achieved through various learning activities tailored to align with the characteristics of competencies and educational content. Engaging in higher-level cognitive processing through Higher Order Thinking Skills is essential for preparing students to tackle global challenges. These skills can be cultivated through: (1) critical thinking and problem-solving; (2) effective communication; (3) creativity and innovation; and (4) collaboration. This new paradigm aligns with the concept of 21st-century skills, which are essential in higher education to equip students for success in an increasingly VUCA (volatile, uncertain, complex, and ambiguous) world. (Aouri & Sabiri, 2024).

In a more concise formulation, the 21st century skills can be categorized into four global domains: (1) Ways of Thinking, which encompass creativity and innovation, critical thinking, problem-solving, decision-making, and the ability to learn how to learn; (2) Ways of Working, which focus on communication and collaboration skills; (3) Tools for Work, which include essential knowledge and competencies in information and communication technology; and (4) Way of Life, which pertains to career development, personal and social responsibility, as well as cultural awareness and competence. (Binkley, Erstad, Herman, & Raizen, 2012). The role of education is recognized not only in a micro context, focusing on the interests of students engaged in the educational interaction process, but also in a macro context, encompassing the interests of society at large, which includes the nation, the state, and the global community. The relationship between education and society also

encompasses the connections between education and social change, economic structures, politics, and governance. (Fadjar, 1999). Despite the same legal formal position as the school system in Indonesia, due to its historical ties, the Madrasah education system has a greater mandate because it is an educational institution or public school with Islamic characteristics (Government Regulation No. 28/29 of 1990). In terms of curriculum, Madrasahs (MI/MTs/MA) offer a more comprehensive range of Islamic studies compared to traditional schools (SD/SMP/SMA). However, these Madrasahs face significant challenges amid various limitations, particularly in infrastructure and human resources. Over time, madrasah education has evolved into a more advanced institution, resulting in considerable progress that aligns it closer to modern schooling. Today, they are structured into levels—elementary, junior high, and senior high—which is believed to enhance the learning experience for students enrolled in Madrasahs. (Albanjari, 2021). To gain a comprehensive understanding of the challenges and issues that madrasahs encounter in the current era of disruption and turbulence, the author seeks to explore various educational practices in madrasahs through scientific research. The study focuses on three specific madrasahs: MAN 1 Kudus, MAN 2 Kudus, and MA NU Banat. To clarify and narrow the scope of this research, the following questions are posed: How do learning practices in Madrasah Aliyah respond to the rapid changes of the VUCA era? What are the learning models employed in Madrasah Aliyah from the perspective of digital technology? What challenges arise in implementing digital technology-based learning within Madrasah Aliyah? What difficulties are faced in the context of higher-order thinking skills in learning at Madrasah Aliyah? Finally, what are the learning outcomes in Madrasah Aliyah when viewed through the lens of digital technology in response to developments in the VUCA era?

2. Methods

2.1. Research Design

This study uses a qualitative approach because it aims to describe and analyze existing phenomena through the presentation of data in the form of words with natural object conditions. As stated by Moleong (2014), qualitative research is research that intends to understand the phenomena of what is experienced by research subjects such as behavior, perception, motivation, actions, and others holistically, and by means of description in the form of words and language, in a specific natural context and by utilizing various natural methods.

This research aims to provide a comprehensive description of the educational practices at MA in Kudus as they respond to and navigate VUCA (Volatility, Uncertainty, Complexity, and Ambiguity) conditions. The study focuses on three selected locations: MAN 1 Kudus, MAN 2 Kudus, and MA Banat NU Kudus. These institutions were chosen purposefully based on several criteria: (1) they are relatively advanced in their educational programs, (2) they are believed to have the capacity to implement creative and innovative initiatives, and (3) they represent a variety of institutional statuses, encompassing both public and private sectors. Quoting from Maghfiroh (2023), MAN 2 Kudus occupies the title of the first best high school level in Kudus district, while MA Banat NU Kudus is in third position. Ihsan (2018) revealed that MAN 1 Kudus also has a long historical value as a madrasa in Kudus where its birth and implementation process was initiated by the community.

2.2 Population and Sample

According to Arikunto (2006), data sources in research are subjects from which data can be obtained. In qualitative research, the data obtained is in the form of words, images, and not numbers. Primary data are basic sources which are the main evidence or witnesses. The study involved a total of 70 participants, which included 3 headmasters, 3 stakeholders, 14 teachers, and 50 students from diverse academic backgrounds, such as grade, major, and interests, across 3 madrasahs. A purposive sampling method was employed to ensure a heterogeneous group, particularly among the students. The student participants, ranging from grades X to XII, represented various programs: science, social studies, tahfidz, research, and regular. Their selection was carried out randomly by their teachers.

2.3 Data Collection

According to Sugiyono (2019), data collection techniques are the most strategic step in research, because the main aim of research is to obtain data. In qualitative research, data collection is carried out in natural conditions (natural settings), primary data sources, and data collection techniques are mostly observation, in-depth interviews and documentation.

2.3.1 Observation

Sukmadinata (2009) explains that observation is a technique or method of collecting data by observing ongoing activities. Through careful observation, researchers can directly examine the object of study, eliminating the potential distortions that may arise from intermediaries who could exaggerate or downplay the actual data. In this research, the investigator employed non-participant observation, ensuring that they remained an independent observer not directly involved in the activities being studied. The researcher meticulously recorded, analyzed, and drew conclusions regarding various phenomena related to educational and learning practices at the MA research site, particularly in addressing the challenges of the VUCA era. Additionally, the researcher utilized structured observation as the instrument, as the observation process was systematically designed.

Prior to conducting the observation, the researcher developed a guideline to serve as a reference, ensuring that the observation process remained focused and aligned with the primary objective: to describe educational and learning practices at the MA research site in response to the challenges posed by the VUCA era.

2.3.2 Interview

As explained by Sugiyono (2019), an interview is a meeting of two people to exchange information and ideas through questions and answers, so that meaning can be constructed on a particular topic. Prior to conducting the interview activity, the researcher developed an interview guideline to ensure that the process remained focused. The selection of informants for this study was based on several key considerations, including their relevance to the research topic and their significant roles in addressing the issues necessary to answer the research questions. Additionally, the interviews were conducted in conjunction with a Focus Group Discussion (FGD).

2.3.3 Document Study

Document study is a complement to the use of observation and interview methods in qualitative research. According to Sukmadinata (2009) documentary study is a data collection technique by collecting and analyzing documents, both written documents, images and electronics. To obtain documentation data, researchers take documents in the form of Daily Lesson Plans (DLP) and Daily Evaluation Forms (DEF). Researchers also take documentation of activities in the form of photos of student activities during learning.

2.4 Data Validity Test

Data validity test in qualitative research includes credibility, transferability, dependability, and confirmability tests (Sugiyono, 2019). In this study, to test the validity of the data, the researcher used a credibility test. According to Sugiyono (2019), the data credibility test or trust in qualitative research data is carried out by extending observations, increasing perseverance in research, triangulation, discussions with colleagues, negative case analysis, and member checksIn assessing the credibility of this study, the researcher employed triangulation. This approach involves verifying data from diverse sources, employing various methods, and conducting checks at different times. Additionally, the instruments were validated by consulting two experts in the linguistic field, leading to the conclusion that the instruments are valid for further use.

2.5 Data Analysis

Miles and Huberman (2014) stated that activities in qualitative data analysis are carried out interactively and continue continuously until completion, so that the data is saturated. Activities involved in data analysis include data reduction, data display, and drawing/verification of conclusions. Data reduction refers to the process of selecting, focusing, simplifying, abstracting, and transforming raw data collected from field notes. This data may originate from observations, interviews, document analyses, and field notes. The aim is to limit the presentation of data to a structured collection of information that facilitates the drawing of conclusions and informed action. Researchers present data concerning various educational and learning phenomena observed at the MA research locations, addressing the challenges posed by the VUCA era throughout the stages of planning, implementation, and assessment. In this study, the data is presented in a descriptive manner.

Drawing conclusions is only part of one activity of a complete configuration (Miles et al., 2014). Data regarding various educational/learning practical phenomena at the MA research locations in responding/answering the challenges of the VUCA era, starting from planning, implementation and assessment. The research that has been presented in the data presentation is interpreted and then analyzed to obtain conclusions.

3. Results and Discussion

VUCA exerts its influence on every field of human activity, including education. VUCA may also be interpreted in terms of quantity and quality of information, which make turbulent transitions in a globalized and digitalized world (Panthalookaran, 2022). From the collected data, the result can

be taken as follows. Before discussing the research data that answers the research questions, the relevance of the challenges of 21st century madrasahs by Kurniawan (2019) is analyzed with interview data from three locations madrasas.

The first is the teacher's mental revolution, in which teachers must be aware that their students will one day return to society. As Hafni, Muklir, Kuntorini, and Riski (2023) stated on their research that everyone played an active role in the implementation of the independent curriculum. Teachers' creativity also allows students to develop their critical, creative, and analytical way of thinking, along with teamwork and communication skill (Mulyoto, Madhakomala, Rugaiyah, Ulrika, & Bjorn, 2023). So teachers must be progressive in guarding their students without being rigid which can actually make them passive figures. The role of teachers and students needs to be adapted to utilize this technology effectively in facing the challenges of VUCA (Volatility, Uncertainty, Complexity, Ambiguity) (Jufriansah, Ma'rup, & Khusnani, 2025). The three MAs selected as research locations feature individuals who are progressive and demonstrate comparable performance, sharing a unified vision and mission. This includes utilizing media that enhances teaching, such as web-based applications and real-time simulation sites, along with consistently preparing PowerPoint slides as visual aids for effective communication. Beyond mere reading ability, digital literacy encompasses critical thinking skills essential for evaluating information obtained through digital media. (Anggraeni, 2019). For this reason, teachers must guess the character of their students, improve their expertise both in the field taught and how to teach it and put their knowledge into practice, do not act contrary to the knowledge they teach (Tafsir, 2010). The relationship between education and society includes the relationship between education and social change, economic order, politics and the state (Fadjar, 1999). This signifies that educational models must be designed to address the evolving needs and demands of society. Consequently, educators must cultivate mental resilience to effectively navigate the ever-changing methods and policies. While the concept of disruption 5.0 highlights the potential for transformation, 5.0 plus underscores the necessity of embracing change. (Albanjari, 2021).

The second is empowering students with 21st century skills. Islamic education in the digital era offers unlimited opportunities to expand accessibility, develop innovative learning methods, and strengthen understanding of religion. Amirotu, Azani, and Mahmudulhassan (2024) stated that globalization has had significant impact on Islamic education. The integration of digital technology holds significant potential for bridging educational gaps and enhancing religious understanding in our increasingly interconnected world. One notable opportunity for Islamic education in the digital age is the expanded accessibility it offers on a global scale. This shift not only facilitates the dissemination of religious knowledge worldwide but also fosters greater awareness and comprehension of Islam within a more connected society. (Hajri, 2023). In such period, besides knowledge and skills, individuals are also required to embody strong character to confront the unpredictable challenges (Burhan et al., 2023).

The third aspect is the integration of technology into learning. To reshape the character of cultured citizens and develop a comprehensive cultural framework, educational reform efforts must genuinely resonate with the core values of society and the nation. In other words, enlightened education should foster both human and cultural transformation. This necessitates effective

educational management and leadership at all levels—macro (central government), meso (regional government), and importantly, at the micro level (schools) to drive educational change and innovation within educational institutions. (Syafaruddin, Asrul, Mesiono, & Wijaya, 2017). For instance, Siu and Garcia (2017 in Mahel, 2021) submits that technology revolution has transformed global higher education by providing a global interconnectedness that restructured educational, social, economic, and cultural life. Moreover, research by Kornelsen suggested that western workplaces are currently experiencing a leadership challenge that relates to conflict between the senior leaders in organizations and the so-called millennial generation (Kornelsen, 2019 in Mahel, 2021). Subjects that previously could only be viewed visually in 2-dimensional black and white in printed books, can now be easily visualized through 3D animated images, simulation videos and accompanying audio for a richer experience.

The fourth is curriculum reformation according to the demands of the 21st century. The curriculum referred to here is the entire educational program which includes methodological issues, objectives, teaching levels, learning materials, and the like (Kurniawan, 2013). Kurniawan (2019) further explained that in order to survive and not be left behind, and starting from the explanation above, it is clear that reform of the current madrasa education curriculum is needed so that it can meet the needs of the 21st century. Several variables need to be developed because they are not in line with the expectation set by the leadership (Hediono, P, & Ellyawati, 2022).

The previous explanation leads to the conclusion that, in addition to the curriculum established by the ministry, madrasahs possess the autonomy to customize their curricula in accordance with collaboratively prepared policies. This adaptability is essential for addressing the challenges of the VUCA era and, most importantly, for fulfilling the needs of those eager to learn. It is evident that madrasahs are trusted institutions, producing intellectual figures with strong moral character. Based on research conducted at MAN 1 Kudus, MAN 2 Kudus, and MAN NU Banat Kudus, we can examine the implementation and outcomes of the efforts made by these three madrasahs in responding to the challenges of the VUCA era, using the four indicators mentioned above.

First is the learning practices at Madrasah Aliyah in responding to speed change in the VUCA era. In responding to speed change in the VUCA era, these madrasas have similarities in terms of learning practices. While the research by Mutil, Busari, Mazlan, and Ujil (2024) shows insufficient readiness of Malaysian school leader to face VUCA era, each madrasah has an IT team that manages the website and social media. Although researchers are aware, most of these programs can be conveyed to the wider community through news passed down from generation to generation, from seniors to juniors, which further builds a compatibility image for prospective students and parents as consumers. As an indicator of the challenges stated by Kurniawan (2019), even though there is a curriculum that is standardized by the ministry, of course in order for madrasas to achieve the expected output, there must be modifications that differentiate them from other schools. At this madrasah, all programs are designed to address contemporary challenges while aligning with the interests of the students. The presence of both specialized and standard programs allows these madrasahs to cater to diverse student groups. However, a shared cornerstone across all offerings is religious moral education. Regardless of their chosen program, students at every level engage with Quran, fiqh, and hadith content to fortify their morals in navigating the complexities of the digital

age. For those who seek a more advanced curriculum, there are specialized and boarding programs, each offering unique advantages. At MAN 2 Kudus, for instance, the preeminent classes provide additional hours for a more comprehensive study of the subjects. Meanwhile, the preeminent program at MA Banat receives further enhancement from Ganesha Operation, one of Indonesia's prominent educational institutions, along with opportunities for educational excursions and campus tours. In alignment with MAN 2 Kudus, MAN 1 Kudus offers its students the distinguished preeminent program, which includes an additional two hours of instruction and research starting from grade 10. The regular curriculum at MAN 1 Kudus remains comparable to that of other high schools, complemented by an extensive religious education. In addition to the enhanced curriculum, all preeminent programs incorporate bilingual instruction.

Focusing on the strengths of each madrasah's preeminent programs, teachers have observed that students enrolled in these programs exhibit greater motivation and quicker intellectual responses compared to their peers in regular classes. Skills such as public speaking during presentations, actively participating in competitions, and engaging in extracurricular activities are commonplace among preeminent program students.

Interviews with these students reveal a remarkable spirit of fastabiqul khairat, characterized by a competitive drive that, while not always outwardly apparent, shapes their daily lives. This environment encourages teachers to innovate and introduce new concepts, as they recognize the potential for such high aspirations to be optimally realized. The madrasah understands that effective teaching not only fosters student achievement but also benefits the teachers, the students' personal growth, and the wider community.

Although it differs slightly, the boarding program also contributes positively to this environment. The boarding program imposes comprehensive restrictions on the use of digital information devices, regardless of their form. On the other hand, the deeper religious knowledge possessed by students, apart from this program, allows boarding students to provide tangible benefits to the surrounding community. For instance, at MA Banat, when the adjacent village hosts a religious event, the boarding students frequently take on the role of performers, whether in recitations or delivering teachings. We recognize that the rapid pace of change today places a significant emphasis on digital literacy as a key component of daily life. However, the boarding program, which may seem misaligned with this fast-changing environment, plays a crucial role in addressing the challenges of the VUCA era by preserving religious teachings that are increasingly rare for Generation Z. Thus, the esteemed program at the madrasah serves an important function amid the swift changes of modern society. Research excellence equips students with a competitive edge in scientific literacy, while boarding excellence fosters outstanding students in the religious realm, acting as guardians of religious values against the negative consequences of the technological age. As research result by Sari, Soamole, and Marsella (2024) suggested, the reveal eight key competencies that are critical for students in the VUCA environment: leadership, digital literacy, communication, emotional intelligence, entrepreneurship, global citizenship, problem solving, and team-working, so those madrasahs being observed managed to show such quality.

Secondly, the implementation of learning models at Madrasah Aliyah from a digital technology perspective is crucial. The rise of educational innovation in Indonesia represents a creative and

forward-thinking response from leaders, experts, and educators in the implementation of the national education system. The strategic roles of planners, program implementers, and evaluators are essential in adapting to both internal and external changes, which requires a proactive response to challenges that impact managerial strength, human resources, and organizational culture in schools, madrasas, and Islamic boarding schools. This adaptability is vital for fostering changes and innovations, as educational advancement necessitates updates in management, curriculum, networked learning technology, and the modernization of educational facilities and infrastructure. (Simatupang, Wasiyem, & Syukri, 2022). In the past, madrasahs received a negative stigma regarding the development of science and technology, but now they have become a trigger for progress as well as a boomerang for those who previously derided them. Rahmatullah, Mulyasa, Syahrani, Pongpalilu, and Putri (2022) showed that digital era 4.0 considered important for teachers to master in the 21st century including ICT skill as reinforced by other researchers such as Kalolo (2019) and Ally (2019). In addition to webinars, which are well-established among academics, students are increasingly incorporating simple web-based technologies as learning tools. It is now quite common for teachers to utilize PowerPoint slides alongside various multimedia resources during lessons, as most classrooms are equipped with at least an LCD projector or a smart TV that also functions as a smart board. While smart TVs offer a range of features and functions that are more diverse than those of laptops connected to LCDs, the real impact on learning stems from how teachers and students engage with and benefit from digital technology.

At MAN 2 Kudus, in addition to using PowerPoint, alternative technologies such as the PhET Colorado website for real-time science simulations and Quizizz for interactive brainstorming and enjoyable learning experiences are frequently employed. Given that the research content is applicable across all programs, MAN 2 Kudus maintains a substantial database of student research journals, which can be accessed on a limited basis through library computers to safeguard digital content copyright. Similarly, MA Banat Kudus utilizes the Ped application for physics simulations and Kahoot for quizzes to enhance the learning experience. Sometimes, there are also teachers who use augmented reality (AR) as an interactive 3D model which further increases students' interest in learning. MAN 1 Kudus is now collaborating with Quipper, one of the providers of online additional learning services as an effort to utilize digital technology to support educational progress after collaborating with Ganesha Operation in previous years. All of the technology above is mobile native so it can be accessed via PC, iOS and Android phone. So the students do not encounter significant obstacles in using it because each student has and can use their own mobile device with the permission of their teacher. The results of the interview show that this new thing has a positive impact because it attracts more interest among the students to explore and be creative on their own outside of school hours. So the use of gadgets is not only for accessing social media, but also for positive things that support academic potential.

Third, the problems faced in the implementation of learning in Madrasah Aliyah with digital technology dimension. While Samuel, Onasanya, and Yusuf (2019) on their research figured out most schhol do not have adequate digital media to facilitate good instruction, from the search results, the most frequently encountered but not significant obstacle is the human resources of teachers. Some senior teachers have some difficulty in using digital technology. Fortunately, many millennial

teachers are actively providing support and assistance, such as creating PowerPoint presentations and preparing ready-to-use simulations. However, it's important to note that while digital technology enhances engagement and offers clearer visuals, it cannot substitute for direct explanations from the teacher. In situations where facilities are limited, simple yet informative simulation applications can be invaluable. Recognizing this, Madrasah Locations has tasked young teachers with consistently leveraging this technology while collaborating with senior teachers to ensure a more equitable distribution of knowledge and resources. In addition, the digital era provides senior teachers with the opportunity to enhance their knowledge by participating in online seminars that are regularly organized by various organizations. This effort is part of the endeavor for teachers, who are digital immigrants, to keep pace with their students—digital natives—when it comes to utilizing technology. However, a significant challenge in the realm of digital technology is the lack of gadgets, which serve as the primary access devices for the tahfidz program. Although only a small number of students participate, the reliance on digital tools can prevent tahfidz students from engaging fully in learning. Aware of this issue, madrasas have implemented solutions. Firstly, when assignments involve the use of gadgets, teachers ensure that groups are composed of both boarding and non-boarding students, allowing everyone to share the same experience. Secondly, teachers have also considered individual assignments that require creating PowerPoint presentations. Since the boarding environment is integrated with the madrasa, students are permitted to use PCs and computer labs, as long as they have proper permission and supervision from a supervisor. Guardians and students need not worry, as their digital literacy is upheld for office applications, even without unrestricted access to the internet. Additionally, there is a WhatsApp group for the guardians of santri, managed by the madrasah's public relations and boarding supervisors, who consistently provide updates and documentation. This allows guardians to communicate indirectly with their entrusted children without concern. Interview results indicate that the issue lies not with the gadgets themselves, but rather with the plethora of features that can distract students from their memorization efforts. Moreover, there is a concern about the potential dilution of the students' unique culture due to exposure to external influences, which may encroach upon Islamic traditions. While this challenge is indeed significant, the value system forms the foundation of the norms that guide individuals both as separate beings and as members of society, which can manifest as either traditional or religious norms that have evolved within the community. The value system serves as a benchmark for human behavior within society, possessing the potential to control, regulate, and guide societal development. It also carries a spiritual significance that helps sustain the existence of the community. However, this value system is immutable, presenting a central challenge for educational institutions, which have a responsibility to uphold the values that evolve within society. It is essential to ensure that the acculturation to foreign cultures does not overshadow the cultural values of our nation. Consequently, educational institutions must offer appropriate responses to ensure that societal tendencies and thought processes remain guided and well-directed. (Syukurman in Basit & Mudlori, 2019). Digital age offers positive opportunities for implementing character education and can shape students' perception of their professional identities formation (Dewi et al., 2023; Guliyeva, Tarana, Rzayeva, & Huseynova, 2021; Sebele-Mpofu, 2024).

Forth, problems faced in learning at Madrasah Aliyah within the frame of the higher order thinking model. Widayat (2018) stated that education in the 21st Century is education that integrates knowledge, skills and attitudes, as well as mastery of digital technology, Information and Communication Technology (ICT). The development of these skills can be facilitated through various learning activity models that align with the characteristics of competencies and educational materials. Engaging students in higher-order cognitive processing, known as Higher Order Thinking Skills, is essential for preparing them to address global challenges. These skills can be cultivated through several key areas: (1) critical thinking and problem-solving; (2) communication abilities; (3) creativity and innovation; and (4) collaboration skills. The essential skills for the 21st century can be categorized into four main areas: (1) Ways of thinking, which encompasses creativity, innovation, critical thinking, problem-solving, decision-making, and the ability to learn independently; (2) Ways of working, which involves effective communication and collaboration; (3) Tools for working, focusing on fundamental knowledge and skills in information and communication technology; and (4) Ways of living, which pertain to career development, personal and social responsibility, as well as cultural awareness and competence. (Binkley et al., 2012). Thinking is categorized into two levels based on the complexity of the process: lower-order thinking and higher-order thinking. These levels correspond to Bloom's taxonomy, which encompasses six components. The first three components remembering, understanding, and applying represent low-level thinking abilities (LOT). In contrast, the next three components analyzing, evaluating, and creating represent high-level thinking abilities (HOT). (Anderson, 2001). At the chosen Madrasah, the higher order thinking model has been adopted in the learning process, with scientific work being a requirement for graduation. Under the guidance of teachers, students are able to develop their skills in analysis, evaluation, and ultimately in creating a product in the form of a written work. Research by Kwangmuang, Jarutkamolpong, Sangboonraung, and Daungtod (2021) and Saputra, Joyoatmojo, Wardani, and Sangka (2019) indicated that learning innovation improve critical skills which is the main point of HOT. Teachers assess that preeminent program students have higher motivation in problem solving and data mining. The problem that arises from the higher order thinking model frame is the conflict between guidance and research activities and class hours. Reduces the portion of main learning in the classroom. Even though this can be minimized with guidance outside of class hours, the effective time for this can only be during class hours because students are in the most fit condition to absorb knowledge. Apart from scientific papers, along with the implementation of the independent curriculum, there is a special P5-P2RA subject which will eventually lead to a work event. Just like scientific work, before the final event there are projects that must be carried out, for example research on local wisdom which requires time, energy and of course money. These various methodologies enhance the critical thingking skills as suggested by several researchers (Bezanilla, Fernández-Nogueira, Poblete, & Galindo-Domínguez, 2019; Indah, Toyyibah, Budhiningrum, & Afifi, 2022). However, to develop students who are Higher Order Thinking with the characteristics of high-level thinking abilities, which is the ability to solve problems (problem solving), decision making (decision making), creative thinking (creative thinking), and critical thinking (critical thinking), the Contextual Teaching Learning learning model can be an effort that can be implemented by educators. Indirectly, application is what makes madrasah students absorb the knowledge gained through experience.

Fifth, learning outcomes at Madrasah Aliyah from a digital technology perspective in responding to developments in the VUCA era. As stated by Karakose, Polat, and Papadakis (2021) and Pettersson (2021), digital leadership and practice digitalization process are many times limited without pedagogical and organizational change. Do the various learning models described above yield tangible results? The findings indicate that, on multiple occasions, students have demonstrated creativity and achievement despite the challenges posed by the pandemic. Furthermore, as Indonesia transitioned into a more normalized phase, madrasahs began a significant movement to mobilize quality human resources, striving to showcase their educational excellence. This initiative aims to provide a head start in unlocking the potential of students in this new beginning. Given the impact of digital technology on education, enhancing schools' digital capacity and fostering digital transformation, madrasahs are increasingly contributing positively to research and development in this area. (Akour & Alenezi, 2022; Timotheou et al., 2023). Several prestigious events organized by various national and international entities have been positively received by the selected madrasas. Reports from interviews and the respective madrasah websites indicate that MAN 2 Kudus earned a gold medal in KSM 2023, the MAN 1 Kudus Research Team secured a bronze medal at the Indonesia International Invention Expo 2023, and MA NU Banat achieved third place in Pospenas 2022. These accomplishments are merely the tip of the iceberg, reflecting the true quality and values of the students within these institutions.

From the teachers' perspective, success in competitions is viewed as a bonus for the collective efforts of all involved. The primary focus remains on the educational process itself. Teachers recognize that parents entrust their children to these madrasas to enhance their knowledge and Islamic values. To support this mission, the madrasas provide various resources, including limited-access gadgets, science and social studies labs, robotics facilities, and studios. Teachers also encourage students aspiring to pursue careers in the digital era, such as content creators, YouTubers, and Instagram influencers. The hope of all educators is that, regardless of the skills they acquire, students will uphold the spirit and character of Islam at every stage of their journey, and that any future content they produce will be rich in educational Islamic values, reflecting the identity of their madrasah. The findings of the research conducted across three madrasas are presented in the table below:

Table 1. The 3 madrasahs data from the research objective

MADRASAH	**Objective 1**	**Objective 2**	**Objective 3**	**Objective 4**	**Objective 5**
	Learning Activities	**Digital Perspective**	**Problem and Solution**	**HOT Model**	**Learning Outcome**
MAN 1 Kudus	preeminent, research, boarding, and regular program, moral education	LCD projectors and smart TVs support, additional content powered by Ganesha Operation and Quipper, webinars	Restricted gadgets use for boarding program students (Solution: open access for PC lab for evening session), WhatsApp	Research projects, discussion, P5-P2RA subject	Various achievements, e.g.: Bronze medal at the Indonesia International Invention Expo 2023

			group for parental supervision by boarding functionaries		
MAN 2 Kudus	preeminent, research, boarding, and regular program, moral education	LCD projectors and smart TVs support, Phet Colorado website, Quizzis app, institute journal database access	Restricted gadgets use for boarding program students (Solution: open access for PC lab for evening session)	Research projects, discussion, P5-P2RA subject	Various achievements, e.g.: Gold medal in KSM 2023
MA NU Banat	preeminent, research, boarding, and regular program, moral education	LCD projectors and smart TVs support, Ped app, AR app, Kahoot app	Restricted gadgets use for boarding program students (Solution: open access for PC lab for evening session)	Research projects, discussion, P5-P2RA subject	Various achievements, e.g.: Second runner-up in Pospenas 2022

4. Conclusion

Based on the data and analysis from research on the challenges faced by madrasas in navigating the VUCA era specifically, their readiness to adapt to the digital age conclusions can be drawn. The selected madrasas have demonstrated commendable efforts in responding to the rapid changes characteristic of this era. They are focused on equipping students with 21st-century skills, integrating technology as a fundamental component of learning, providing facilities that support various activities, and fostering an innovative approach among teachers in utilizing technology. The educational programs offered—including preeminent, tahfidz, and regular classes are designed to be flexible, catering to the diverse needs of the community. Acknowledging that rapid change impacts not only skills but also moral values in the social context, these madrasas consistently emphasize the instillation of Islamic values within daily learning. From a digital technology perspective, the madrasas have demonstrated an appropriate capacity for integration. Tools such as PowerPoint have become commonplace for teachers in their daily instruction. Additionally, various applications such as Phet Colorado for simulations, augmented reality (AR), and quiz platforms like Quizizz and Kahoot enhance the learning experience by reducing the time and costs associated with traditional lab tests and real-time materials. Furthermore, madrasas collaborate with Quipper, an online education service provider, to offer lessons and practice questions. Several teachers have also proactively developed question databases and article journals that are accessible through exclusive

channels, ensuring that copyright protections are maintained while preserving the essence of the knowledge shared.

The challenges encountered in implementing digital technology within Madrasah Aliyah are certainly unavoidable. What merits attention are the actions that can be taken to address these issues. For instance, while many senior teachers may have limitations in using the latest technology, they are consistently supported by their millennial counterparts, allowing them to gradually become more proficient on their own. Additionally, Tahfidz students, who are typically limited in their use of electronic devices, can still access computers in the lab under strict supervision from their caregivers. This ensures that even if they do not possess personal gadgets, they will nonetheless gain the ability to operate a computer upon graduation, preparing them for everyday tasks. The Higher Order Thinking (HOT) model is also naturally integrated into the learning process with the independent curriculum that includes the P5-P2RA program. However, one persistent issue for madrasahs implementing the HOT model is that it often requires significant time, energy, and financial resources, which can disrupt the primary teaching and learning activities. Regular guidance on the process of preparing scientific work, conducted during effective hours, plays a crucial role. While it is true that some unavoidable challenges have yet to be addressed with concrete solutions, the outcomes of these activities positively impact students' abilities in higher-level thinking. The learning outcomes at Madrasah Aliyah, particularly from a digital technology perspective, demonstrate satisfactory responses to developments in the VUCA era. This technological era, characterized by big data, presents a unique advantage for madrasas, enhancing their activities. The availability of the internet for reference searches and various supporting applications serves as valuable tools for both teachers and students in expanding their knowledge in their respective fields of study. Evidence of this progress is reflected in the numerous achievements showcased on each madrasah's website, and interviews indicate that, without digital technology, achieving these results would require significantly more time and resources.

5. References

Akour, M., & Alenezi, M. (2022). Higher education future in the era of digital transformation. *Education Sciences*, *12*(11). doi:10.3390/educsci12110784.

Albanjari, N. I. (2021). *Madrasah Berkeadaban di Era 5.0*. In *Webinar Nasional Pendidikan Islam Berkeadaban I* (pp. 107–112). Medan: Fakultas Agama Islam, Universitas Dharmawangsa. Retrieved from https://proceeding.dharmawangsa.ac.id/index.php/PFAI/article/view/21.

Ally, M. (2019). Competency profile of the digital and online teacher in future education. *International Review of Research in Open and Distributed Learning*, *20*(2). doi:https://doi.org/10.19173/irrodl.v20i2.4206.

Amirotu, D., Azani, M. Z., & Mahmudulhassan, M. (2024). The concept and context of Islamic education learning in the digital era: Relevance and integrative studies. *Profetika: Jurnal Studi Islam 2024*, *25*(1). doi:https://doi.org/10.23917/profetika.v25i01.4239.

Anderson. (2001). *A Taxonomi for Learning, Teaching, and Assessing*. New York: Wesley. Retrieved from https://www.jstor.org/stable/42926529.

Andri, S., Lubis, M. A. S., Sari, D. R., & Chyntia, O. D. (2023). Essential hard skill for student in VUCA era: Literature study. *Journal of Trends Economics and Accounting Research*, *3*(4). doi: https://doi.org/10.47065/jtear.v3i4.634.

Anggraeni, H. (2019). Penguatan blended learning berbasis literasi digital dalam menghadapi era revolusi industri 4.0. *Al-Idarah: Jurnal Kependidikan Islam*, *9*(2), 190–203. Retrieved from https://www.researchgate.net/publication/364029838.

Ani, J., Lumanauw, B., & Tampenawas, J. (2021). Bauran promosi dan e-service quality pengaruhnya terhadap keputusan pembelian Grabfood (Study pada pengguna jasa Grabfood di kota Manado pada masa pandemi covid-19). *Jurnal EMBA*, *9*(2). Retrieved from file:///C:/Users/Core I5-gen3/Downloads/iogi2018,+09.+JILHANSYAH+ANI.+OK.pdf.

Aouri, Z., & Sabiri, H. (2024). Higher education in a VUCA-driven world: The need for 21st century skills. *Travaux de Linguistique*, 1. doi:10.34874/IMIST.PRSM/liri-v5i1.49975.

Aribowo, H., & Wirapraja, A. (2018). Strategi inovasi dalam rangka menjaga keberlanjutan bisnis dalam menghadapi era volatility, uncertainty, compelexity, dan ambiguity (VUCA). *JIMAT (Jurnal Ilmu Manajemen Dan Akuntasi Terapan*, *9*(1). Retrieved from http://jurnal.stietotalwin.ac.id/index.php/jimat/article/view/153.

Arikunto, S. (2006). *Prosedur Penelitian: Suatu Pendekatan Praktik (Edisi Revi)*. Jakarta: PT Rineka Cipta. Retrieved from https://inlislite.uin-suska.ac.id/opac/detail-opac?id=3766.

Basit, A. B., & Mudlori, M. I. (2019). Analisis problematika tantangan madrasah sebagai tipologi lembaga pendidikan Islam dan solusi dalam menghadapi era globalisasi. *Ta'limuna*, *9*(2), 12–23. doi:https://doi.org/10.32478/talimuna.v8i2.254.

Bezanilla, M. J., Fernández-Nogueira, D., Poblete, M., & Galindo-Domínguez, H. (2019). Methodologies for teaching-learning critical thinking in higher education: The teacher's view. *Thinking Skills and Creativity*, *33*, 100584. doi:https://doi.org/10.1016/j.tsc.2019.100584.

Binkley, M., Erstad, O., Herman, J., & Raizen, S. (2012). *Defining Twenty-First Century Skill*. London: Springer International Publishing. doi:http://dx.doi.org/10.1007/978-94-007-2324-5_2.

Burhan, N., Wizarati, A., Tyas, P., Abd, M. N. Z. B., Zaki, Y. H. I., Juhari, A. I. B., & Saputra, K. D. (2023). Model of character education for college students in the era of VUCA. *Jurnal El-Tarbawi*, *16*(1). doi:https://doi.org/10.20885/tarbawi.vol16.iss1.art2.

Dewi, A. C., Az-Zahra, P. F., Nirwana, Ilmi, N., Putri, N. D., & Sari, P. D. (2023). Challenges and opportunities for character education in the digital era. *International Journal of Sustainability in Research (IJSR)*, *1*(4), 239–248. doi:https://doi.org/10.59890/ijsr.v1i4.646.

Fadjar, A. M. (1999). *Madrasah dan Tantangan Modernitas*. Bandung: Mizan. Retrieved from https://lib.ui.ac.id/detail.jsp?id=2752.

Guliyeva, A., Tarana, A., Rzayeva, U., & Huseynova, R. (2021). Lifelong education as a challenge of digital era. *Turkish Journal of Computer and Mathematics Education*, *12*(6), 1282–1289. https://turcomat.org/index.php/turkbilmat/article/view/2468 .

Hafni, N., Muklir, Kuntorini, D. A. D., & Riski, A. (2023). Local government policies analysis: Implementing curriculum changes in VUCA era. *International Journal of Social Relevance & Concer*, *11*(7), 8–11. doi:10.26821/ijsrc.11.7.2023.110703.

Hajri, M. F. (2023). Pendidikan Islam di era digital: tantangan dan peluang pada abad 21. *AL-MIKRAJ Jurnal Studi Islam Dan Humaniora*, *4*(1), 33–41. doi:https://doi.org/10.37680/almikraj.v4i1.3006.

Hapudin, M. S. (2022). *Pengantar Ilmu Pendidikan Memasuki Era Revolusi Industri 4.0*. Depok: Rajawali Press. Retrieved from https://www.rajagrafindo.co.id/produk/pengantar-ilmu-pendidikan-dr-muhamad-soleh-hapudin-m-si/.

Hediono, B. P., P, M. P., & Ellyawati, J. (2022). College readiness in living the VUCA era through digital 4.0 transformation based on matrix importance-performance analysis results. *International Journal of Research in Management and Social Science*, *10*(3), 98–100. Retrieved from http://katalog.ukdw.ac.id/id/eprint/9286.

Hendrarso, P. (2020). *Meningkatkan Kualitas Sumber Daya Manusia di Perguruan Tinggi Menuju Era VUCA : Studi Fenomenologi pada Perguruan Tinggi Swasta*. In *Prosiding Seminar STIAMI*. Retrieved from https://ojs.stiami.ac.id/index.php/PS/article/view/949.

Hermananis. (2021). *Keterampilan Penting Abad 21 yang Perlu Dipelajari Anak*. Retrieved from https://rumahinspirasi.com/16-keterampilan-penting-abad-21-yang-perlu-dipelajari-anak/.

Ihsan. (2018). Penguatan pendidikan agama Islam pada madrasah aliyah di Kudus. *Edukasia: Jurnal Penelitian Pendidikan Islam*, *13*(1), 207–226. Retrieved from https://journal.iainkudus.ac.id/index.php/Edukasia/article/view/3576.

Indah, R. N., Toyyibah, T., Budhiningrum, A. S., & Afifi, N. (2022). The research competence, critical thinking skills and digital literacy of Indonesian EFL Students. *Journal of Language Teaching and Research*, *13*(2), 315–324. Retrieved from https://jltr.academypublication.com/index.php/jltr/article/view/2378.

Jufriansah, A., Ma'rup, & Khusnani, A. (2025). Optimizing the role of teachers and students in the digital era in facing VUCA challenges. *Journal of Social and Community Development*, *1*(02), 105–117. doi:10.56741/jscd.v1i02.798.

Kalolo, J. F. (2019). Digital revolution and its impact on education systems in developing countries. *Education and Information Technologies*, *24*(1), 345–358. doi:10.1007/s10639-018-9778-3.

Karakose, T., Polat, H., & Papadakis, S. (2021). Examining teachers' perspectives on school principals' digital leadership roles and technology capabilities during the covid-19 pandemic. *Sustainability*, *13*(23). doi:10.3390/su132313448.

Kurniawan, S. (2013). *Pendidikan Karakter: Konsepsi & Implementasinya secara Terpadu di Lingkungan Keluarga, Sekolah, Perguruan Tinggi dan Masyarakat*. Yogyakarta: Ar-Ruzz Media. Retrieved from https://inlislite.uin-suska.ac.id/opac/detail-opac?id=946.

Kurniawan, S. (2019). Tantangan abad 21 bagi madrasah di Indonesia. *Intizar*, *25*(1). doi:https://doi.org/10.19109/intizar.v25i1.3242.

Kwangmuang, P., Jarutkamolpong, S., Sangboonraung, W., & Daungtod, S. (2021). The development of learning innovation to enhance higher order thinking skills for students in Thailand junior high schools. *Heliyon*, *7*(6). doi:10.1016/j.heliyon.2021.e07309.

LeBlanc, P. J. (2018). Higher education in a VUCA world. *Change: The Magazine of Higher Learning*, *50*(3–4), 23–26. doi:10.1080/00091383.2018.1507370.

Maghfiroh, S. (2023). *Top 6 SMA dan MA Terbaik di Kabupaten Kudus, Benarkah MAN 2 Kudus Peraih Ranking Pertama?* Retrieved 15 August 2024, from https://malang.jatimnetwork.com/pendidikan/3798391431/top-6-sma-dan-ma-terbaik-di-kabupaten-kudus-benarkah-man-2-kudus-peraih-ranking-pertama?page=2.

Mahel, T. A. (2021). Leadership competencies for the volatile, uncertain, complex and ambiguous (VUCA) environment: Challenges to higher education. *European Journal of Humanities and Educational Advancements*, *2*(5). doi:https://doi.org/10.17605/OSF.IO/DAC3Q.

Maskanah, & Lusiana, S. (2021). Efektivitas penggunaan teknologi dalam pembelajaran daring di masa pandemi covid-19. *Jurnal Jendela Pendidikan*, *1*(4). Retrieved from https://media.neliti.com/media/publications/465727-none-a1a2ba34.pdf.

Miles, M. B., Huberman, A. M., & Saldana, J. (2014). *Qualitative Data Analysis: A Methods Sourcebook*. London: Sage Publication.

Moleong, L. (2014). *Metode penelitian kualitatif edisi revisi*. Jakarta: Remaja Rosda Karya. Retrieved from https://opac.perpusnas.go.id/DetailOpac.aspx?id=1133305.

Mulyoto, M., Madhakomala, M., Rugaiyah, R., Ulrika, B., & Bjorn, O. (2023). Teacher's creativity in the VUCA era: A systematic literature review using bibliometric analysis. *Journal Neosantara Hybrid Learning*, *1*(2), 110–128. doi:10.55849/jnhl.v1i2.100.

Mutil, G., Busari, A. H., Mazlan, M. N. A., & Ujil, A. T. (2024). Readiness of school leaders in Malaysia to face the Vuca (volatile, uncertain, complex, ambiguous) era: A recent comprehensive structured review. *International Journal of Education, Psychology and Counseling*, *9*(55), 556–575. doi:10.35631/IJEPC.955037.

Panthalookaran, V. (2022). Education in a VUCA-driven world: Salient features of an entrepreneurial pedagogy. *Higher Education for the Future*, *9*(2), 234–249. doi:10.1177/23476311221108808.

Pettersson, F. (2021). Understanding digitalization and educational change in school by means of activity theory and the levels of learning concept. *Education and Information Technologies*, *26*(1), 187–204. doi:10.1007/s10639-020-10239-8.

Rahmatullah, A. S., Mulyasa, E., Syahrani, S., Pongpalilu, F., & Putri, R. E. (2022). Digital era 4.0: The contribution to education and student psychology. *Linguistics and Culture Review*, *6*(S3), 89–107. doi:10.21744/lingcure.v6nS3.2064.

Samuel, N., Onasanya, S. A., & Yusuf, M. O. (2019). Engagement, learning styles and challenges of learning in the digital era among Nigerian secondary school students. *International Journal of Education and Development Using Information and Communication Technology (IJEDICT)*, *15*(4), 35–43. Retrieved from https://files.eric.ed.gov/fulltext/EJ1239637.pdf.

Santoso, Purnomo, A., & Herman. (2020). Strategi Kebudayaan dalam Negara Hukum untuk Menyongsong Adaptasi Kebiasaan baru. *Jurnal Ilmu Dan Budaya*, *41*(72). Retrieved from file:///C:/Users/Core I5 gen3/Downloads/1024-2404-1-PB-1.pdf.

Saputra, M. D., Joyoatmojo, S., Wardani, D. K., & Sangka, K. B. (2019). Developing critical-thinking skills through the collaboration of jigsaw model with problem-based learning model. *International Journal of Instruction*, *12*(1), 1077–1094. Retrieved from https://files.eric.ed.gov/fulltext/EJ1201249.pdf.

Sari, D. N., Soamole, A., & Marsella, P. E. (2024). Preparing student's competencies to face the challenges of the VUCA (volatility, uncertainty, complexity, ambiguity) era. *Journal of Development Economics and Digitalization, Tourism Economics (JDEDTE)*, *1*(3), 181–190. doi:https://doi.org/10.59407/jdedte.v1i3.926.

Sarid, A., & Levanon, M. (2023). Embracing dualities: Principles of education for a VUCA world. *Educational Philosophy and Theory*, *55*(12), 1375–1386. doi:10.1080/00131857.2022.2162384.

Sebele-Mpofu, F. Y. (2024). Hidden curriculum in accounting education in the digital era: The evolution, role, controversies, challenges and implications. *Cogent Arts \& Humanities*, *11*(1), 2402123. doi:10.1080/23311983.2024.2402123.

Simatupang, W., Wasiyem, & Syukri, M. (2022). Inovasi pendidikan Islam pada perkembangan madrasah menghadapi tantangan perubahan. *Bunayya: Jurnal Pendidikan Guru Madrasah Ibtidaiyah*, *31*(1). doi:https://jurnal.stit-al-ittihadiyahlabura.ac.id/index.php/bunayya/article/view/195.

Sugiyono. (2019). *Metode Penelitian Pendidikan Pendekatan Kuantitatif Kualitatif dan R&D*. Bandung: Remaja Posda Karya.

Sukmadinata. (2009). *Metode Penelitian Pendidikan* (cet. V). Bandung: Remaja Posda Karya.

Syafaruddin, Asrul, Mesiono, & Wijaya. (2017). *Inovasi Pendidikan: Suatu Analisis Terhadap Kebijakan Baru Pendidikan*. (Candra & Usiono, Eds.). Medan: Perdana Publishing. Retrieved from http://repository.uinsu.ac.id/id/eprint/140.

Tafsir, A. (2010). *Ilmu Pendidikan dalam Perspektif Islam*. Bandung: Remaja Rosdakarya. Retrieved from https://scholar.google.com/citations?user=GeRI8HgAAAAJ&hl=id.

Timotheou, S., Miliou, O., Dimitriadis, Y., Sobrino, S. V., Giannoutsou, N., Cachia, R., Ioannou, A. (2023). Impacts of digital technologies on education and factors influencing schools' digital capacity and transformation: A literature review. *Education and Information Technologies*,

28(6), 6695–6726. doi:10.1007/s10639-022-11431-8.

Widayat, W. (2018). *Implementasi Pengembangan Kecakapan Abad 21 Melalui Fitur Kelas Maya Portal Rumah Belajar*. Retrieved from http://pena.belajar.kemdikbud.go.id/2018/09/implementasi-pengembangan- kecakapan-abad 21-melalui-fitur-kelas-maya-portal-rumah-belajar.