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Digital Transformation in Education: Forms, ContributingFactors, and Impacts

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Abstract
This study intends to catalogue the types of digital technologies utilized in learning interactions, accessing learning resources, and conducting assessments online. Additionally, it makes an effort to examine the internal and external factors that support learning through digital technology and their effects on student learning outcomes. This study employs a descriptive qualitative methodology. Data were gathered using observation, documentation studies, and interviews. To map the position of the school in digital-based learning, data on internal and external factors were analyzed through an internal and external factors evaluation matrix. According to the study's findings, websites, e-modules from kemendikbud.go.id, YouTube, Google Scholar, Google Docs, and other digital technology platforms are used to access learning resources. Quiz, Google forms, and e-reports are used for learning assessment while Zoom, Google Meet, What's App, and Quiz are utilized for learning interactions. The study of internal and external factors' outcomes demonstrates that the school's strengths over weaknesses allow it to respond quickly to the threatsposed by digital-based learning. It is possible to overcome the threats of time management in online learning by leveraging a variety of digital technology apps that enhance student learning outcomes.
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1. Introduction

Digitalization needs changes to technology, culture, and business practices and integrates digital technologyinto every part of life (Athanassios & Vasiliki, 2019), including education. Adoption of digital technology in the classroom allows for learning that is based on it (Mahlow & Hediger, 2019). A paradigm shift from non-technology to technology-based learning is encouraged by the widespread usage of digital technologyin society. Schools are becoming more aware of the untapped potential of the digital transition to enhance learning efficiency and collaboration (Demartini et al., 2020). Digitization has become essential for the field of education. In fact, teacher need extensive pedagogical support in creating digital teaching (Amhag et al., 2019). A wide range of topics are involved in the digital transformation of education, including infrastructure, teachers, training, learning, learning materials, socioeconomic improvement, technical advancement, and policies.(Romero-Ivanova et al., 2020; Iivari et al., 2020; Conrad et al., 2020). The prospective school's image captured researchers' attention (Zhang & Bray, 2020). Future designs for classrooms will include multiple screens, wireless internet access, lab simulators, smart watches, and mind-reading technology to help learning (Edirisinghe, 2019). A virtual training tool's real-world application is introduced by Kamińska et al. in 2021. In reality, learning innovation has been created by Kwangmuang et al. (2021) to improve students' higher order thinking abilities. These studies' descriptions of the design of the digital transition in education do not appear to have manifested in actual classroom life, particularly in Indonesia.

Nearly every industry, including education, is being impacted by and changing due to digital transformation (Balyer & Öz, 2018; Widana, 2020) provides evidence that instructors' ability to create HOTS-based evaluations is significantly impacted by their level of digital literacy. Digital technology also contributes to the academic culture that develops in the classroom. The main challenge is promoting its appropriate use (Singh, 2021). Therefore, a critical analysis of the use of digital technology in education is necessary (Hills,David & Thomas, 2020). If not, the process of the educational system adjusting to the dynamics of the development of digital technology encounters delays. Nearly all Indonesian schools still struggle with a serious digital divide. Only 20% to 25% of teachers are thought to employ digital technology in the classroom (https://bdkjakarta.kemenag.go.id/). In order to close the digital divide, pupils should have access to digital learning resources. In order to do this, the Minister of Education Nadiem Makarim launched the School Digitization Program in 2021, which consists of four activities: (1) enhancing digital platforms; (2) providing educational content on TVRI; (3) providing educational materials and digital education media models; and (4) providing information and communication technology for learning (Kompas.com., 2020).

Numerous empirical research show that there is no connection between the use of digital technology and

learning outcomes (Englund et al., 2017). However, a number of scholars are particularly interested in the study of the connection between digital technology and education. The association between student participation in technology-enhanced learning and digital abilities is examined by Bergdahl et al., in their work from 2020. A study was done by Heidari et al. in 2021 to look into the connection between students' academic engagement and their digital competence, using digital informal learning as a mediating factor. In contrast, García-Peñalvo, (2021) provides an institutional frame of reference for eLearning in Higher Education in his research by considering the dangers posed by the unethical use of technology, which results in the negative aspects of the transformation process. The Barakina et al., (2021) study promotes the use of artificial intelligence and digital technologies in education. In the framework of the digital transformation, Gafurov et al. (2020) demonstrate how digital technology influences the paradigm shift in higher education, from resource management to access control. In order to accelerate the accomplishment of sustainability outcomes, Türkeli & Schophuizen (2019) underline the urgent need to connect the potential created by the digital transformation in education with circular economy education. Digitalization in education is directly tied to a new way of life in a digital environment and the emergence of generations who were born and educated in the particular setting, according to research on the subject of digitalization in modern education undertaken by Ronzhina et al. in 2021. These investigations served as the basis for this research, which looked at how digital technology is used in learning, how internal and external factors affect it, and how digital transformation has affected learning.

This study is based on the argument that while digital technology can progress education, it can also lead to new issues that need to be resolved by schools as well as teachers acting in their roles as learning leaders (Englund et al., 2017). According to a poll by the British Digital Education Organization, the majority of the time, the benefits of digital technology for supporting learning are only employed to facilitate communication rather than to foster more effective learning (Newman & Beetham, 2017). (Marcelo & Yot-Dominguez, 2019) demonstrates that, other from presentations, collections of text papers, and films forstudents, the usage of digital technology in the learning process is uncommon in Spain. Digital transformation is indeed a significant and influencing component in learning, both when teachers explore learning resources, when they prepare lesson plans, and in learning exchanges, according to a number of prior research. Even when teachers plan the assessment's execution, digital transformation is significant and impactful. It is understood, however, that a variety of factors, both internal (such as strengths and weaknesses) and external (such as opportunities and threats) contribute to learning and may have an effect on both the effectiveness of teachers and the learning results of their students.

This study seeks to fill in the gaps left by earlier research, which tended to emphasize just a limited role for technology in education. This study also aims to show how unprepared schools are for the digital revolutionthat the Digital Age brings about. To that end, the research in this study precisely maps the typology of digital technology forms used by teachers to access learning resources, to engage with students, and to conduct assessments using digital methods. Additionally, this study makes an effort to analyze both internaland external aspects that support learning via digital technology. These problems serve as springboards for elucidating the nature of digital transformation, its underlying causes, and its effects on education in the digital age.

2. Method

This research is a field research with a qualitative descriptive design format with a phenomenological and descriptive approach to understand phenomena related to reality, situations, and conditions of digital transformation in learning, internal and external environmental factors that contribute and the impact of digital transformation on learning. Data was collected through interviews, observations, and documentation studies involving all Mathematics, Chemistry, Biology, Physics, Indonesian, and English teachers at Senior High Schools in Palopo City. The data collection and analysis techniques used refer to the theory of Miles and Huberman, (2014) including: (1) Data collection in the form of field notes, recordings, or documents; (2) data condensation refers to selecting, focusing, abstracting, simplifying data; (3) data display through organized collection of information to conclude and take action; (4) drawing a conclusion/verifying based on the analysis carried out and compiling the evidence found in the field. Data on internal and external factors that contribute to digital-based learning are analysed using the IFE (Internal Factors Evaluation) matrix and the EFE (External Factors Evaluation) matrix to map the position of schools in digital transformation in learning.

3. Forms of Digital Technology in Learning

The forms of digital technology used by teachers in browsing digital learning resources to compose teaching materials are YouTube, Google Schoolar and e-modules from Kemendikbud.go.id. There is only one teacher who uses a digital library to complete the teaching materials prepared in the Learning Implementation Plan. In fact, digital libraries really support online learning, especially during the COVID-19 pandemic (Mubarok, 2021). That is why, many schools/organizations/offices design digitallibraries to meet their own needs (Ardianto, Sukri & Wahyuni, 2019; Batubara et al., 2019; Nurajizah, 2019;Siyasih, 2021). Digital libraries are also useful

for increasing public literacy interest through virtual tourism (Lies Siti Khadijah et al., 2020). Especially during the pandemic, digital libraries are the main alternative in providing services (A. D. Lestari et al., 2021).

When compiling lesson plans, the form of digital technology used by teachers to store teaching materials is Google Classroom. There are some teachers who are more creative in creating their own websites for students to visit through the shared links. Teacher creativity and innovation are needed in designing learning plans to be more optimal (Primayana, 2019). In addition, they also look for relevant websites as additional references for students to access. In this Digital Era, the website is the choice of many teachers inpreparing lesson plans (R. H. Lestari et al., 2020). It is interesting to note 12 tips suggested by Reyna & Meier (2020) to help educators transition to online learning.

In learning, although teachers are accustomed to using zoom and meet, What's App Groups are the main media in accessing material and experiments in practicum. What is interesting is that students are used to using Prezi and Canva in completing the task of making posters and pamphlets containing learning materials. The learning platform that is often used is Google Classroom. This is in line with the research results of Setiadi et al. (2021) who found that the most widely used platforms in Indonesia from 2015-2020 were Edmodo, Moodle, MOOC, and Google Classroom. However, there is a tendency that social media thatis not a learning platform is treated like a learning platform so that it has implications for the use of various forms of media and platforms which then began to be widely accepted. In an effort to facilitate virtual learning, it seems important to consider Multitouch Learning Books (MLB) a kind of interactive e-book as an interactive learning companion that facilitates virtual learning. The use of interactive e-books through digital interactions develops the concept of sustainability in the minds of students (Seibert et al., 2020).

In carrying out the assessment, the teacher uses What's App for the midterm and final exams for easily accessible and inexpensive. For daily tests, students usually work on questions that have been prepared in Google Classroom. Student marks are stored using the E-raport (Electronic Report) application. Various applications can actually be used in the assessment. (Berg et al., 2021) offers a Game-based Assessment Application to measure students' knowledge. To measure the skill aspect, the teacher can use a padlet or wall wisher in the form of an online bulletin board (Jong & Kim Hua, 2021). Ideas and answers in the form of words, links, images, videos and other related materials are displayed on a 'wall' within the application whose contents can be viewed by anyone who has access to the Padlet address (Rashid et al., 2019). In addition, von Kotzebue et al. (2021) developed the DiKoLAN-Grid Self-Assessment Tool, which is a self-assessment tool that can guide the understanding of the performance level of basic competencies to be achieved in science learning. In Indonesia, the Scola Learning Management System has also been widely used by schools at various levels (Imtiyaz, 2020).

4. Internal and External Factors Contributed to Digital Transformation

The results of the Internal Factor Evaluation (IFE) analysis show that the total weighted score is 2.753 (> 2.5), as shown in Table 1. This means that the ability of the internal factors of State Senior High Schools in Palopo City is very strong. This shows that the strengths of the schools are actually able to overcome their weaknesses in digital-based learning. The main strength of State Senior High Schools in Palopo City in digital-based learning is the "high commitment of the principal in supporting digital-based learning" with a weight of 0.250, a rating of 4, and a score of 1,000. The principal's commitment is shown by motivating teachers to use digital technology in learning and providing opportunities for teachers to take part in various capacity building and competency development trainings in designing and implementing learning using media or applications and online-based methods. The principal's commitment is also shown through concrete actions in providing facilities in the form of bandwidth even though it is not yet fully sufficient forlearning needs due to budgetary difficulties. This is in line with the research of Siahaan et al. (2020) which identifies the principal's commitment through the provision of supporting facilities and organizing workshops and learning technical guidance. Principal coaching is a commitment that involves strong and sincere skills (Psencik, 2019). The principal's commitment to supporting digital-based learning is quite important to help teachers master and apply digital technology in learning in this Digital Age. Jost, (2021) emphasizes that commitment is very important for principals in carrying out their duties. Wahyudin et al. (2020) also proves that commitment has a significant effect on employee performance.

The schools' main weakness is that "having no specific budget for training and development of digital technology" with a weight of 0.083, a rating of 1, and a score of 0.083. In fact, training and development of digital technology for teachers is very important in the Digital Age. Multi-directional and dynamic relationships in strategy are needed to improve teacher experience in developing digital competencies (Howard et al., 2021). In fact, Sailer et al. (2021) assert that teachers' basic digital skills and technology-related teaching skills are more important than digital technology resources themselves. For thisreason, teachers are expected not only to be in-depth users of educational technology, but also to be involved in the design of digital environments (Engeness, 2021). To succeed in the learning process, teachers need digital technology-based media which requires them to improve their literacy and expertise inmaking digital learning media that is enjoyble for students (Rusli, 2021).

Table 1 Internal Factors Evaluation (IFE)

No	Internal Factors	Grade	Weight	Rating	Score
	Strengths				
1	High commitment of the principal in supporting digital-based learning	**3**	**0,250**	**4**	**1,000**
2	Teachers have high motivation in participating both in offline and online training.	2	0,167	3	0,501
3	Adequate teacher qualifications	2	0,167	3	0,501
	Total		**0,584**		**2,002**
	Weaknesses				
4	Inadequate digital technology facilities	2	0,167	2	0,334
5	The schools have no specific budget for training and digital technology development	**1**	**0,083**	**1**	**0,083**
6	There are still some teachers who have not been able to take full advantage of IT	2	0,167	2	0,334
	Total		**0,417**		**0,751**
	Internal Total Score				**2,753**

Actually, teachers have a high enough opportunity to improve their competence. In the Digital Age, providers of instructional design training and guidance are rife in online media. A number of institutions/organizations and lecturer associations offer various trainings through online media using applications, including Microsoft Team, Google form, Google Classroom, and Repositoty. Kampus Guru Indonesia, for example, holds various webinars to improve teaching skills. At the time of this research, Kampus Guru Indonesia had held 13 webinars and trained 2,153 Online Class participants from 309 districts/cities throughout Indonesia (kampusguruindonesia.com). Likewise, the Ministry of Education, Culture, Research, and Technology through the Center for Development of Education Quality Assurance in each province holds various online workshops (p4tkbmti.kemdikbud.go.id). The online workshops are also enlivened by Pasar Trainer Academy, C&G Training Network, Eximus Learning, and Learning & Coaching, and others (pasartrainer.com). To maximize the ability of schools, external managerial network 'capabilities' are needed (Zyzak, 2020). Capabilities include the knowledge, skills, and experience of the organization that enable it to operate and use resources to work effectively (Andersén, 2011). Capabilities and resource capabilities that are created simultaneously in an organization can create a competitive advantage (Aujirpongpan & Hareebin, 2020). On this side, the principal's leadership, motivation and managerial skills are needed.

The results of the external factor evaluation (EFE) analysis show that the total weighted score is 2.771 (> 2.5), as shown in Table 2. This means that state senior high schools in Palopo City have a high opportunity to overcome challenges in digital-based learning. This shows that schools are actually very responsive in overcoming threats in digital-based learning. The main opportunity for State Senior High Schools in Palopo City in digital transformation in learning is “technology advances that make it easier for creative teachers in digital transformation with a weight of 0.231, a rating of 4, and a score of 0.924. Yılmaz (2021) proves that technological ability has a significant effect on teachers' creative thinking. Zabidi (2019) also revealed that the use of technology in learning increases teacher creativity. Teachers' epistemic beliefs about creativity influence technology-based creativity development practices in learning to trigger creativity, support idea development, create digital products, scaffold creative processes, enhance creative collaboration, and facilitate the evaluation of students' creative outcomes (Olofsson & Lindberg, 2014). However, in utilizing technology, teachers are required to have skills, understand strategies and are trained to use digital technology in learning (Yesi Arikarani, 2021).

The main threat is "the demand for teacher competence is getting higher" with a weight of 0.076, a rating of 1, and a score of 0.076. In the Digital Age, society and the global economy are changing and influenced by artificial intelligence that characterize the Digital Age (Adolfsson, 2020). The role of digital technology is very important in providing reliable data and information. All these new developments have brought disruption in various sectors of life, including education. Disruption and innovation are faster than ever, both in terms of development and diffusion (Schwab, 2016; Kasza, 2019). In the Digital Age technology has configured a new scenario in the field of education. Goldie, (2016) argues that the emerging connectivism as a learning theory describes the continuous and complex development of learning in the digital social world. All of this require an increase in teacher competence in utilizing digital technology in learning.

No	External Factors	Grade	Weight	Rating	Score
	Opportunities				
1	There are various certified online trainings organized by third parties	3	0,231	3	0,693
2	Technological advances that make it easier for creative teachers in digital transformation	**3**	**0,231**	**4**	**0,924**
3	Government policy on "Sekolah Penggerak"	2	0,154	3	0,462
	Total		**0,616**		**2,079**
	Threats				
4	Demands for quality standards of education that respond to advances in digital technology are increasing	2	0,154	2	0,308
5	The demand for teacher competence is getting higher	**1**	**0,076**	**1**	**0,076**
6	Applicability of accreditation for secondary schools	2	0,154	2	0,308
	Total		**0,384**		**0,692**
	External Total Score				**2,771**

Based on the results of the analysis using the IFE and EFE Matrix, each obtained a total internal score = 2.753 on the IFE Matrix and a total external score = 2.771 on the EFE Matrix. The results of the analysis in Figure 1 place the position of State Senior High Schools in Palopo City in quadrant V. Digital transformation in learning is in the Hold and Maintain condition. This position allows the State Senior HighSchools in Palopo City to optimize teacher competency development by being more proactive in collaborating with training institutions and motivating teachers to make efforts to develop competency-based empowerment.

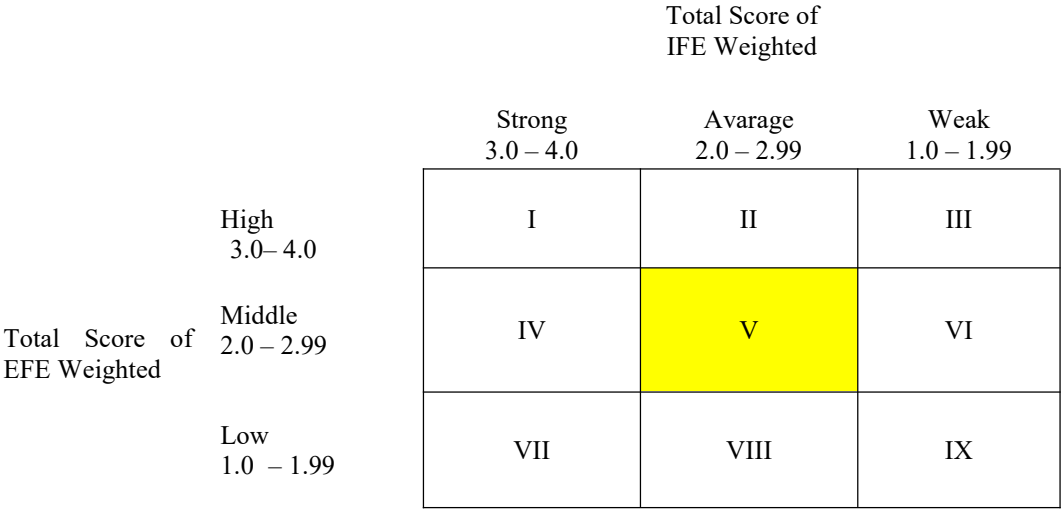

Figure 1 Position of Senor High Schools in Palopo city in Digital Transformation

5. Impacts of Digital Transformation in Learning

The impact of digital transformation in learning can be seen in student learning outcomes. The acquisition of student scores in the last three years has increased even though schools have been affected by the COVID-19 pandemic. The difficulty of teachers in managing online learning time is overcome by maximizing the use of various online learning applications, namely zoom, Google meet, Google classroom,What's App, Google docs, and quiz. Even, some teachers create their own website to support online learning. Of course, at the beginning of the pandemic many teachers were in shock, but slowly they were able to rise up and overcome various obstacles faced in learning. This has an impact on the acquisition ofthe average score of students who remain good and have increased from 57.02 in 2019 to 85.02 in 2020 and 85.95 in 2022. This finding confirms the results of Hayri Sarı & Aydoğdu (2017) which found thattechnology-assisted learning had a positive impact on student achievement and performance. Bozkuş (2021)in his research reveals that the infrastructure of digital technology devices affects student learning outcomes more than the capacity of teachers to use digital technology devices. A number of studies have proven the influence of digital technology on student learning outcomes (Rozal et al., 2021; Ahmad & Hamad, 2020; Basir et al., 2021; Dewa et al., 2020). Thus, the fulfilment of digital technology infrastructure needs to be a school's top priority.

6. Conclusion

The results of this study indicate that: first, the forms of digital technology used in browsing learning resources are YouTube, Google scholar, Google Docs, websites and e-modules from Kemendikbud.go.id. Zoom, Google

Meet, What's App, Quizizz are used in learning interactions, and Quiziz, Google forms, e-reports are used in the implementation of the assessment. Digital technology has become an important driving force in advancing education, especially in learning interactions. The critical question is whether digital technology is increasingly being used by teachers in learning and is in line with needs and is well documented. Second, the results of the analysis of the evaluation of internal and external factors show that the strengths of the school are able to overcome their weaknesses and are very responsive to threats in digital transformation in learning. This condition allows schools to take advantage of strengths and opportunities to overcome weaknesses and threats. Third, Teacher's difficulties in managing time in online learning can be overcome by utilizing various digital technology applications so that it has an impact on increasing the value of student learning outcomes. An important finding of this research is that digital technology helps teachers in developing learning, but the teacher's physical presence in learning interactions remains something very important. The physical presence of the teacher in learning builds an emotional and affectionate connection that no technology can replace.

Research Limitation

This study has not tested the quality of the questions used in school and national exams that are used as data in revealing the impact of digital transformation in learning. For this reason, further research is needed to examine the relationship between the quality of digital-based learning, the quality of exam questions, and student learning outcomes.

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