Transformation in Basic Education: Teacher Self-Regulation Model in Digital Learning

Ni Putu Eni Astuti [1], I Nyoman Sudiana [2], Ida Bagus Putrayasa [3] & I Made Candiasa [4]

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1. Students, Doctoral Program Pendidikan Dasar Universitas Pendidikan Ganesha, Indonesia.
2,3. Lecturer, Program Pascasarjana Pendidikan Bahasa Indonesia Universitas Pendidikan Ganesha, Indonesia.
4. Lecturer, Program Pascasarjana Ilmu Pendidikan Universitas Pendidikan Ganesha, Indonesia.
Email: [1]eni@student.undiksha.ac.id, [2]nyoman.sudiana@undiksha.ac.id,
[3]ib.putrayasa@undiksha.ac.id, [4]candiasa@undiksha.ac.id,
ORCID ID: [1]0000-0002-1347-0154, [2]0009-0002-7008-7378, [3]0000-0003-0647-2730, [4]0000-0003-3808-1339

Abstract

Self-regulation in digital learning in Indonesia focuses too much on limiting students' physical activity without paying attention to teachers' readiness to implement digital learning. Therefore, this research aims to formulate a conceptual model representing elementary school teachers' self-regulation strategies in digital learning environments. This research uses a quantitative approach to describe three aspects of teacher behaviour in implementing digital learning: motivation and experience in implementing digital learning and the level of self-regulation in the digital learning environment. This research used as subjects 36 teachers from 6 elementary schools in Bali Province. The research results show that the most of elementary school teachers in Bali Province have high motivation to learn new technology, adopted technology in learning activities, and show a high level of self-regulation to use technology in learning. These results have several implications, namely that the government needs to prepare policies and allocate funds to support technology-based learning at the elementary school level. Schools must prepare adequate and representative facilities to support technology-based learning.

Keywords: _Digital Learning, Elementary School Teacher, Self-Regulation._

1. INTRODUCTION

As many as 1.6 billion students from 200 countries have disrupted regular face-to-face and physical learning activities due to the COVID-19 pandemic [1]. The COVID-19 pandemic is driving fundamental changes in learning, especially regarding teachers' adoption of digital learning environments [2], [3]. The post-pandemic circumstance still requires teachers to integrate digital learning, so that the teaching and learning process can be effective, although, in some cases, this can limit physical activities that are advantageous for students; for instance, physical activities can be replaced by watching exercise through learning videos. Therefore, the success of teachers in responding to educational challenges in the digital era depends on their self-regulation abilities in organizing digital learning [4].

All teachers, especially at the elementary school level, must understand the concepts, strategies, and implementation of self-regulation well to answer this challenge, which aligns with the teacher's pedagogical competence and personality. Skills in Information and Communication Technology (ICT) are also essential for teachers to effectively conduct digital learning [5]. Therefore, teachers' self-regulation strategies are essential for aligning themselves with students and delivering successful digital learning [6].

Teacher self-regulation impacts the technical aspects of digital learning and is closely related to teachers' pedagogical content knowledge, beliefs, and motivation in the teaching process [7]. Self-regulation includes six strategies teachers can adopt: objective setting, environmental arrangement, task strategies, time management, look for help, and self-evaluation [8]. Self-regulated learning (SLR) is a significant for student motivation and academic achievement, so elementary school teachers must implement this strategy in digital learning [9].

Self-regulation in digital learning in Indonesia focuses too much on limiting students' physical activity without paying attention to teachers' readiness to implement digital learning. Therefore, this research purpose to extend this gap by formulating a conceptual model representing primary school teachers' self-regulation strategies in digital learning environments. By understanding the teacher self-regulation strategy model, teacher performance and behaviour in self-management during the teaching process can be identified, which will impact changes in the digital learning environment of elementary school teachers.

2. LITERATURE REVIEW

2.1. Self-Regulation

Based on the social cognitive approach, self-regulation consists of three phases: forward-thinking, performance, and reflection [10]–[12]. Theoretically, this cycle process is based on four assumptions, namely that students can construct learning targets based on their internal cognitive system; students can manage and supervise the cognitive, motivational and behavioural components of their learning; independent learning is affected by internal factors such as biological, emotional and cognitive factors, as well as external factors like environment; and students can evaluate learning objectives, supervise their behaviour and cognitive processes, and use the results of these evaluations to regulate their learning. In other words, self-regulated learning is a systematic learning process that directs thoughts, feelings and actions to construct, control, utilize facilities and measure learning achievements to achieve academic goals. Therefore, the implementation of self-regulated learning by teachers includes people who have learning efforts, aware of their strengths and limitations, and persistent in their personal targets and assignments [13]. Teachers who can self-regulate can direct their thoughts, feelings, and actions by planning learning activities to achieve the targets and goals they want to achieve in learning [4].

Teachers as representative of self-regulated learning (SRL) include knowledge, beliefs and motivation relevant to several indicators of teacher competence and professionalism [14]. Teacher self-regulation significantly affects several aspects, such as teacher motivation, confidence and achievement [15]. Implementation of self-regulation learning can influence the optimization of the digital learning environment and academic achievement. Self-regulated learning (SRL) has proven effective in technology-based digital learning [16]–[18]. This is because digital learning can overcome space and time constraints and provide opportunities for students to be self-directed while they are learning [19]. The teacher's self-regulation learning strategy will encourage teachers to put maximum effort into organizing digital learning to achieve the best results [20]. Teachers are expected to have a reference for the varieties of approaches in designing digital learning that stimulate independent learning, such as setting targets, using effective methods, controlimg progress, taking notes, organizing learning, and building a productive work environment [4]. From the quotes above, teacher self-regulation in

digital learning is the teacher's ability to regulate independent learning, including cognitive, motivational and technology-based digital learning behaviour elements.

Elementary school teachers' readiness to adapt to the post-COVID-19 pandemic learning environment and, as a consequence of the impact of the industrial revolution, is essential. The existence of digital technology currently creates a gap, teachers as digital immigrants and students as digital natives, thus requiring the development of teachers' methods and expertises in teaching, guiding and motivating students [21]. Increasing literacy and competency in Information and Communication Technology (ICT) is needed so elementary school teachers can utilize technology in learning. This requires good motivation and experience in information technology to achieve the expected goals in a digital learning environment [22]. Self-regulation strategies are needed so that teachers can set goals, plan, manage, control and reflect on the digital learning they do. The self-regulation strategy consists of four elements that can be taken by elementary school teachers, including planning activities, which is related to setting targets for learning, time, and performance; strategy selection and decision making, which relate to which strategy to use for an assignments, or when change strategies for performing a task; resource allocation, which is related to the control and regulation of the use of time, effort, learning speed and performance; and volitional control, which relates to the control and regulation of motivation, emotions, and the environment [23]. If identified, the four elements described above are only part of two cycles, namely forward thinking and performance control, while the elements in the reflection section are not yet visible. As completeness of these three parts, the reflection part starts from the evaluation phase, which is related to examining the process of implementing the strategy, the learning outcomes that have been achieved, as well as checking the suitability of the strategy with the type of learning task being faced and reflecting on each phase during the current cycle (Sumarmo, 2002). Thus, it can be concluded that the self-regulation strategy consists of three cycles, namely first, forward-thinking with several elements such as planning activities, selecting strategies and making decisions; second, performance control with elements of resource allocation and voluntary control; and third, reflection with elements of evaluation and reflection. Elementary school teachers need to understand and strengthen each element of this strategy to develop self-regulation in presenting digital learning to students.

2.2. Digital Learning

The development of digital computing technology was the most critical turning point within the history of distance education [25]. Email, web-based resources, learning management systems, and online discussion boards are critical technologies supporting interactive and flexible distance education. As the first form of distance education that enabled interaction between students and new pedagogies methods. According to Siemens (2015), ideas expressed by Dewey (1897), Piaget (1959), and Vygotsky (1978), who saw learning as knowledge construction by students. Through their social intuitive rather than acquiring facts from teachers [25].

The development distance education is also following by increasing used of several terms, like *online* and web-based learning. These two types of learning are universally accepted to represent the most popular distance education of the 21st century. Blended learning is another essential form of learning that has received significant research attention. Blended learning is learning that includes learning in class and learning online. It is worth noting that blended mode learning and hybrid learning are two other terms that are usually used interchangeably with blended learning. It is certain that both types of instruction, traditional

classroom learning and online learning, must be present for learning to be considered blended. Still, there needs to be a clear consensus on the relative percentages of each. For example, Allen, Seaman, and Garrett (2007) argue that learning with 30-79% of *online instruction* should be considered blended learning. Traditional instruction must represent at least 50% of overall learning to be considered blended learning. Another view says that all mixtures of *online* and traditional instruction should be considered blended learning, even traditional courses that only use an LMS for communication [27].

The increasingly sophisticated and speedy development of information and communication technology, such as computer specifications and internet coverage and speed, provides an alternative for conducting online learning. *Online* learning, also called *e-learning* or digital learning, uses the internet to create online classes. Classrooms typically go through a *cloud-based learning management system* (LMS). Teachers and students, in this case, are involved with class material. It transitions traditional physical classrooms to *online environments* using technology to simulate in-person interactions. Online or digital learning is a type of distance learning [26].

Digital learning via computers or mobile devices is the most popular form of distance learning. Digital learning significantly increases student and teacher interaction compared to traditional distance learning. Additionally, course materials are immediately available to students rather than waiting to receive them in the *US Postal Service mail*. Students receive feedback faster in various forms, such as email, video, audio, or text. The advantage of digital learning is that it is a fun medium, raising students' interest in digital programs [28, p. 6]. Students who study well will quickly understand computers or can quickly develop necessary computer skills by accessing the Web. Therefore, students can study anywhere at any time. Based on these advantages, there are at least two reasons for the need for digital learning: the potential for digital learning and the function of digital learning. According to Kitao (1998), there are several potentials for digital learning as a communication tool, information access, and an education and learning tool. Meanwhile, several functions that have an impact due to digital learning include changes in learning design, learning strategies, and student abilities.

2.2.1. Impact of Changes in Learning Design

The initial activity in digital learning is creating a digital learning design (Sims, p. 26). Designs cannot be created instantly but require comprehensive research and analysis. For this reason, principles are needed in the design process. Digital learning includes efforts made by learners with the principles of freedom, independence, flexibility, recency, suitability, mobility, and efficiency [28]. The principle of freedom means that the learning system is democratic because it is designed so that anyone can freely follow it. Furthermore, students are heterogeneous regarding conditions or characteristics, including motivation, intelligence, training, learning opportunities, and duration. Therefore, the curriculum content, program presentation methods, and learning processes are specifically designed, not limited to pre-determined learning materials, location, distance, time, degree, age, gender, and non-academic matters.

2.2.2. Impact of Changes in Learning Strategies

Implementing the right strategy can make digital learning more efficient and offer advantages over conventional face-to-face learning [28]. Additionally, digital learning can expand the physical and social face-to-face learning that has been implemented so far. In digital learning, students can access tools or materials that allow them to repeat learning material and

interact with other students even though their locations are different and far away. Tools or media such as computers play a huge role in improving the quality of digital learning. Unlike conventional time-limited face-to-face learning systems, this learning can involve students taking an active and interactive role through media. The learning system using this media can also monitor student activities and then evaluate the activities carried out by students through reports to teachers to find out how students are learning (*learning to learn*) so that teachers become increasingly aware of students' learning abilities.

2.2.3. Changes in Student Ability Levels

The changing impact of digital learning can be seen in student ability levels. In this paper, the student ability level is limited to student motivation, student involvement in learning, and learning outcomes.

2.2.3.1. Student Motivation

Digital technology helps change human behavior, including students currently studying, searching for, collecting, documenting, processing, and transferring teaching materials as needed. Mixing teaching materials in the learning process with digital technology can be more exciting and motivate learning because the mix of teaching materials is not monotonous in the text but can be mixed more aesthetically and interestingly because it is combined with images, audio, video, and animation so that it can influence learning behavior for students. Develop better [31].

### 2.2.3.2. Student Engagement

Digital learning can increase student engagement. Matas' research (2014:123) states "that technology can encourage students to engage deeply in learning content and contribute to student learning outcomes. For example, Rachel, a student, was very invested in her project about the American Revolution. He wanted to teach himself how to use the Prezi program to create engaging presentations. In class, he voiced deep frustration when the program proved more difficult to use than he expected, and he did not know how to insert videos he found online. Rachel persevered; however, when she got home and returned to school, she successfully created a presentation with a complete Prezi that she was very proud of. This shows that digital learning can increase student involvement in learning.

2.2.3.3. Learning Outcomes

Achievements, learning outcomes, or learning achievements express the same idea: student academic learning outcomes through learning. Learning outcomes are indicators for measuring student learning effects. Digital learning influences student learning outcomes. The research results of Lin et al. (2017) show that digital learning can relatively improve student learning outcomes. This depends on how the teacher implements digital learning in the classroom. In addition, teachers must create learning situations for students who want to use digital learning so that students dare to ask questions in discussions and increase online interactive learning with teachers.

3. RESEARCH METHODOLOGY

To understand teachers' self-regulation strategies in digital learning, this research uses interview techniques with a quantitative approach to describe three aspects of teacher behavior in implementing digital learning, namely IT experience, IT motivation, and level of self-regulation.
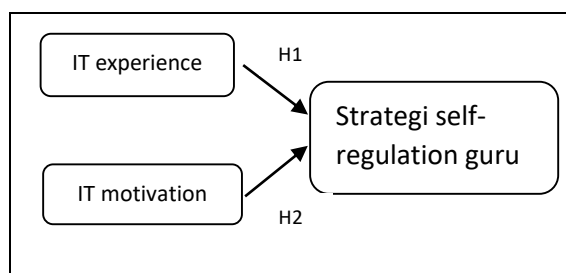
Figure 1: Research Model

The research population is elementary schools in urban, suburban, and rural areas in Bali Province. Based on these subjects, this research obtained a sample of 36 elementary school teachers from 6 schools. The data in this research was obtained from interviews and questionnaires. The data in this research is in the form of technological tools in learning, motivation for using IT, and self-regulation strategies in digital learning. The dimensions of each piece of data collected are presented below.

Table 1: List of Digital Tools in Learning

1	**Word processing application (e.g., Ms. Word)**
2	Spreadsheet Application (For example, Ms. Excel)
3	Presentation Applications (For example, Ms. Power point)
4	Photo Editing Application
5	Voice Recorder Application
6	Video Editing Application
7	Digital camera
8	Scanner
9	Digital Music (e.g. MP3, I-Tunes)
10	Web Based Learning (platform, assessments, lessons, worksheets)

Table 2: Motivation Dimensions

No.	Dimensions	Variable
1	Study digital technology	Motivation to learn new technology
2	Use of digital technology	Motivation to use digital technology in the learning process
3	Adopt technological innovation	Motivation to adopt technological innovation

Table 3: Self Regulation Instrument

No.	Cycle	Dimensions	Variable
1	Thinking ahead	Plan activities	1. Determine learning objectives
			2. Determine the use of time
			3. Determining learning outcomes
		selection and decision-making	4. Formulate lesson plans/teaching modules
			5. Determine learning methods
			6. Prepare learning materials
			7. Prepare learning media
			8. Prepare optional learning strategies
2	Performance control	A source location	9. Discipline in using time
			10. Provide additional study time
			11. Consultation with colleagues
			12. Studying material and learning from social media
		Volitional control	13. Stimulate children's enthusiasm for learning and curiosity
			14. Conduct initial apperception
			15. Maintain children's attention and focus

No.	Cycle	Dimensions	Variable
3	Reflection	Evaluation elements i	16. Examine the strategy implementation process with the learning outcomes that have been achieved.
			17. Check the suitability of the strategy with the type of learning task given
			18. Evaluate children's learning outcomes
		Reflection	19. Reflection on each phase during the walking cycle
			20. Documenting children's learning outcomes

In this research, descriptive statistics were used for data analysis techniques. The analysis was carried out using descriptive analysis to determine the level of IT experience, the level of IT motivation, and the level of teacher self-regulation. Apart from that, to determine teacher self-regulation, researchers used criteria referring to Table 4, while the data processing used a spreadsheet.
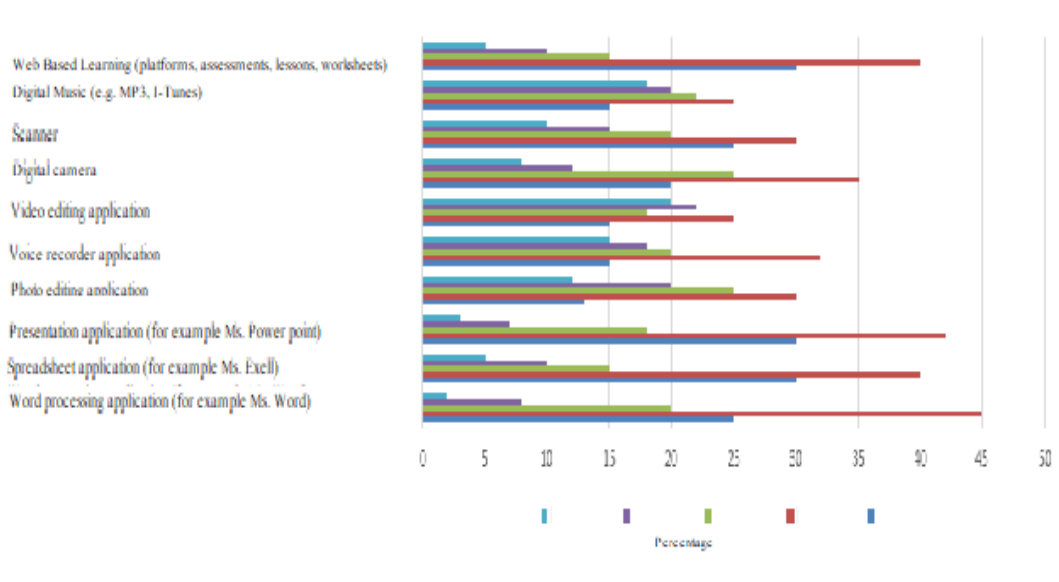
Table 4: Self-Regulation

No.	Score	Criteria
1	84.2 - 100	Very good
2	68.2 - 84	Good
3	52.2 - 68	Enough
4	36.2 - 52	Not enough
5	0-36	Very less

4. RESULT AND DISCUSSION

4.1. Use of Technology Tools in Learning

The questionnaire results on the use of technology tools in learning by elementary school teachers in Bali Province can be presented in the following picture.
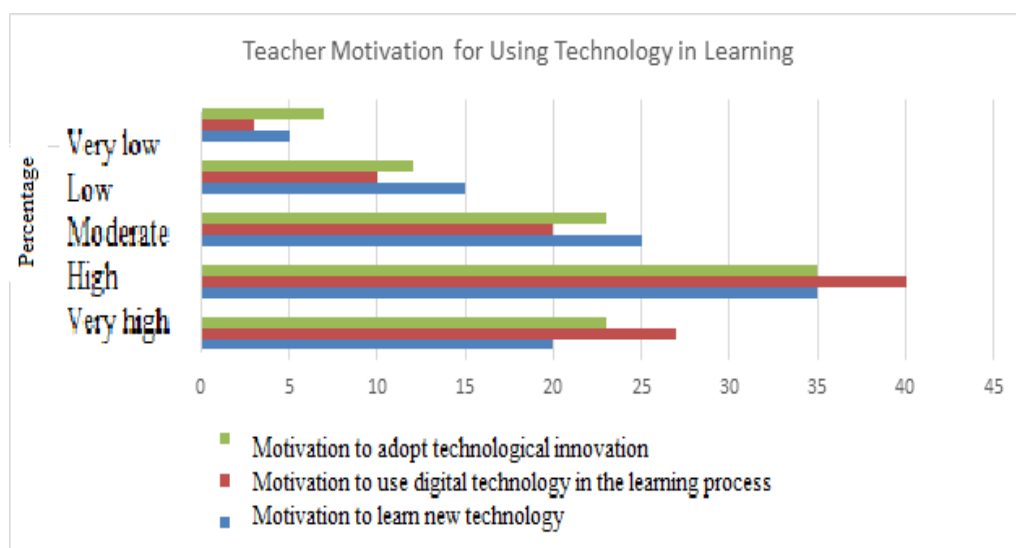

Figure 2: Use of Technology Tools in Learning

The results of the questionnaire show that the majority of elementary school teachers have adopted technology in learning activities. These results are confirmed by the interviews, which state that most teachers have used technology in the learning they carry out [33]. This technology integration is in line with the TPACK (Technological et al. Knowledge) theory,

which states that effective teachers are those who have knowledge of content, pedagogy, and technology and are able to integrate them harmoniously into learning [34]. The importance of word processing applications, spreadsheets, and presentations supports the theory that the use of productivity software such as Microsoft Office can increase teacher efficiency in managing materials and communicating with students [35]. The use of photo editing and sound recording applications shows awareness of the importance of visual and auditory elements in learning, which is by multimedia learning theory [36], which states that multimedia elements can increase understanding and retention of information. Although the use of video editing applications and digital music is lower, this aligns with research findings indicating that teachers may need more support and training in integrating these multimedia elements [37]. The significant use of web-based learning reflects the increasing trend of digital education [38], which emphasizes the importance of utilizing online platforms in supporting more interactive and globally connected learning. Thus, the results of this questionnaire provide a rich and relevant picture of how elementary school teachers adopt technology in education, as well as provide direction for the development of more effective policies and training in supporting the integration of technology in education.

4.2. Teacher Motivation for Using Technology in Learning

The results of the Teacher Motivation Questionnaire for Using Technology in Learning for elementary school teachers in Bali Province can be presented in the following picture.

Figure 3: Percentage of Teacher Motivation in Using Technology in Learning

Questionnaire results show that the majority of elementary school teachers have high motivation to learn new technology, use digital technology in the learning process, and adopt technological innovation. The interview results are in line with the results of the questionnaire. Interview results show that the majority of teachers are highly motivated to use technology in learning. This is consistent with the findings of previous studies, which show that teacher motivation is a key factor in the successful implementation of technology in learning. Motivation to learn new technology is an important foundation.

Most teachers show a fairly high level of motivation, which is in accordance with self-determination theory (SDT), which emphasizes the importance of intrinsic motivation, namely motivation that comes from the individual's internal desires [39].

High motivation to use digital technology in the learning process illustrates that teachers recognize the positive potential of technology in increasing student interaction and involvement in learning. This is in line with the Technology Acceptance Model (TAM) theory, which states that perceptions of usefulness and ease of use influence users' intentions to adopt technology [40]. The motivation to adopt technological innovation shows that elementary school teachers are ready to try new things in learning. Rogers et al. (2014), in their theory of Diffusion of Innovations, state that innovators and early adopters who have high motivation are the key to accelerating the adoption of innovation in a group. However, the presence of a small number of teachers with low or very low motivation indicates that there are potential obstacles that need to be examined further. Factors such as uncertainty regarding the capabilities or benefits of using technology are obstacles that need to be overcome through more intensive training and support programs. The importance of support and training in increasing teacher motivation in integrating technology has been emphasized by Ertmer (2005) and Guskey (2002). Training programs designed according to teachers' needs can increase their level of comfort and competence in using technology [43].

Overall, the questionnaire results offer a rich picture of primary school teachers' level of motivation in adopting technology. Several solutions to increase teacher motivation and digital competence can be implemented by increasing digital literacy, providing adequate support, and designing effective training programs, which are the keys to ensuring the successful implementation of technology in the educational environment.

4.3. Teacher Self-Regulation Level

The results of the questionnaire on the level of self-regulation of elementary school teachers in Bali Province regarding learning using technology can be presented in the following picture.
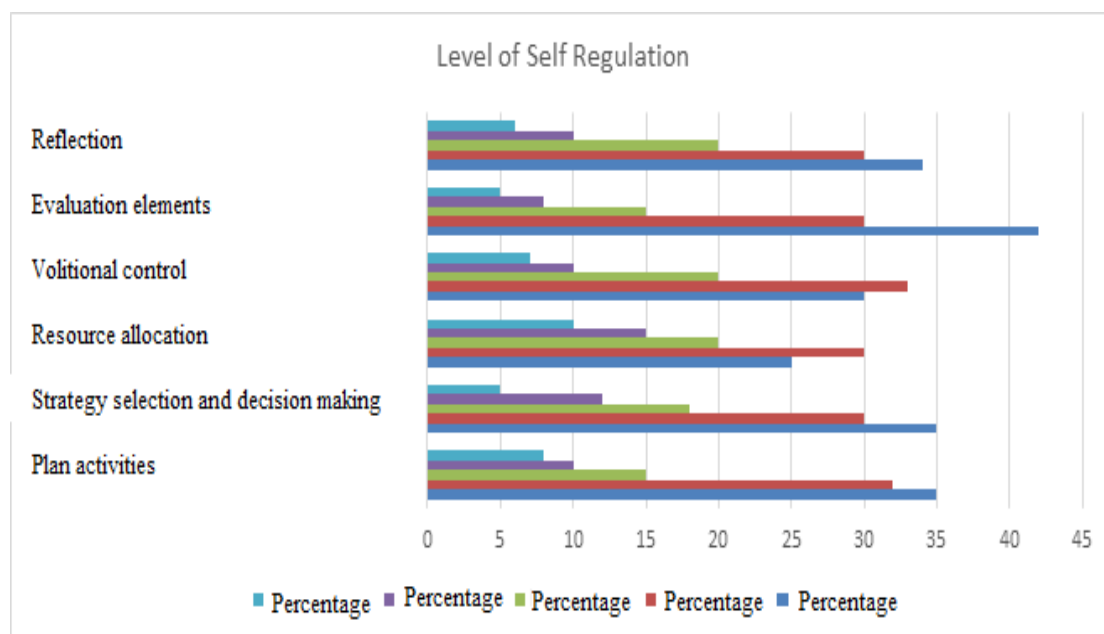
Figure 4: Teacher Self-Regulation Level

Based on the results of the questionnaire, most elementary school teachers show a high level of self-regulation when using technology in learning. These results are supported by interview results, which reflect that the majority of teachers have a high level of self-regulation.

The high percentage in the dimensions of planning activities, strategy selection, resource allocation, volitional control, evaluation elements, and reflection reflects teachers' readiness to manage and control the use of technology in their learning activities. These teachers tend to have a well-thought-out plan, the ability to choose appropriate strategies, and a willingness to evaluate and reflect on their experiences with technology.

The stage of planning activities, which is considered important, shows that the teacher has prepared planned steps before implementing technology in learning. This is in line with self-regulation theory, which states that planning is the first step in managing oneself to achieve certain goals [44].

High levels of strategy selection, resource allocation, volitional control, elements of evaluation, and reflection confirm that teachers can utilize technology effectively, manage resources wisely, control the will to overcome challenges, evaluate the results of using technology, and reflect on their learning practices. These results support the theory that self-regulation is closely related to self-involvement in resource management and evaluation of actions taken [11].

The importance of self-regulation in the context of teachers' use of technology has been recognized by various studies. According to Azevedo et al. (2010), self-regulation is a critical aspect of understanding and utilizing technology in educational contexts. The results of this questionnaire are in line with research findings, which show that self-regulation makes a significant contribution to the success of integrating technology into learning [10].

In the resource allocation dimension, the questionnaire results show a fairly high level. This is in line with self-regulation theory, which emphasizes the importance of managing and allocating resources effectively to achieve goals [44]. Research by Wood et al. (2005) also shows that resource allocation, including technology, can increase learning effectiveness.

This, the results of this questionnaire provide a positive picture of the level of self-regulation of elementary school teachers regarding the use of technology in learning. However, it should be remembered that increasing self-regulation capacity still requires ongoing efforts through appropriate training and support. The integration of self-regulation theory in the development of training programs can be a useful step in increasing teacher readiness in facing the dynamics of educational technology.

5. CONCLUSION

Research on teachers' self-regulation models in digital learning in digital transformation in primary education found several results, including that the majority of elementary school teachers in Bali Province have adopted technology in learning activities; most elementary school teachers in Bali Province have high motivation to learn new technology; Most elementary school teachers in Bali Province show a high level of self-regulation in using technology in learning. These results have implications for several things, including schools having to prepare more complete facilities in terms of facilities and infrastructure that support technology-based learning, and the government needs to prepare policies to support technology-based learning for elementary schools.

Apart from that, the government needs to realize the need for facility support to support the quality of technology-based learning in elementary schools.

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