Digital Transformation in Early Childhood Education: Teachers' Self-regulated Model for Digital Learning

Bayu Rima Aditya* and Andrisyah

***Abstract*—The Covid-19 pandemic has impacted the world of education, especially for lower levels of education such as early childhood education. It has changed its teaching pattern into innovation by implementing online learning. Therefore, teachers need to have a good self-regulated strategy to achieve the online learning goals. This study aims to describe a conceptual model for representing the self-regulated strategy of early childhood teachers in digital learning using a quantitative survey approach. The data collection involved 100 early childhood teachers in Indonesia with a focus on the analysis of three aspects of teachers' behavior in a digital learning environment: 1) IT experience, 2) IT motivation, and 3) online self-regulated strategy. The study proposed a conceptual model for teachers' self-regulated strategy to implement digital learning. The study also noted that based on the technology perspective, both IT experience and IT motivation play a critical role in affecting teachers' self-regulated strategy for digital learning. The main contribution of this study was to provide an understanding of the importance of a self-regulated strategy for teachers toward innovation in early childhood education in a digital learning environment. In doing so, the results of this study can be regarded as a starting point for incentive future research for the successful implementation of digital transformation in early childhood education.**

***Index Terms*—Innovation learning, digital learning, digital transformation, early childhood education.**

I. Introduction

The Covid-19 pandemic is changing the way teachers teach in a digital learning environment, including early childhood teachers. Successful teachers teaching in a digital environment depend on the quality of teaching self-regulation [1]. Early childhood teachers need a good online self-regulated strategy to answer this challenge. This is in line with the pedagogic competencies. Early childhood teachers should have ICT skills for effective digital learning. Therefore, the online self-regulated strategy for teachers is very important in bridging the digital learning process in early childhood education.

There is no definite definition of teacher self-regulation. However, researchers point to a teacher's ability to control the resources in their environment [2, 3]. In other words, teaching practice can be improved by increasing teacher self-regulation. This teacher self-regulation applies both to traditional teaching contexts, as well as online teaching [4]. This is important to note with the prison process, starting from the design of learning, the use of teaching media, the selection of teaching content, and others [5].

Every teacher has a different self-management and strategies for teaching. Bandura's social cognitive theory explains that the personal aspect, the behavior aspect, and the environmental aspect are interrelated when a teacher tries to self-regulate [6]. A teachers' self-regulated is close to teacher motivation, teacher behavior, and teacher cognition in the teaching process [7]. According to [8], there are six strategies for teaching self-regulation: 1) goal setting, 2) environmental structuring, 3) task strategies, 4) time management, 5) help-seeking, and 6) self-evaluation. Therefore, early childhood teachers need to instill these strategies to develop self-regulated digital learning.

The topic of self-regulation is not new in the context of early childhood education. Several previous studies have tried to discuss how to help develop self-regulated skills based on the student's point of view [9–11]. Over time, researchers began to also discuss self-regulated skills with a different focus, namely based on the teacher's point of view [12–14]. This is important to discuss because it helps teachers achieve a balance between their resources and the demands of the profession as a teacher [1]. In addition, the skills of teachers' self-regulation have been increasingly demanded since the pandemic that required teachers to teach in a digital environment [15]. Therefore, more theoretical support is needed to support teachers' self-regulation skills in the context of digital learning.

However, the limited amount of literature discussing teachers' self-regulation in digital learning is an obstacle to the success of digital learning, especially in the context of early childhood teachers. So, this study aims to fill the gap by describing a conceptual model for representing the self-regulated strategy of early childhood teachers in a digital learning environment. By knowing the teachers' self-regulated strategy model, it will also know the performance or behavior of teachers in self-management in teaching and this will have an impact on changes in the digital learning environment of early childhood teachers.

II. Literature Review

In general, a teacher's self-regulated is a systematic learning process that directs thoughts, feelings, and actions towards the achievement of actions towards achieving goals, including academic aspects: 1) improve reading comprehension, 2) become a good writer, 3) learn how to distract, and 4) ask relevant questions, or socio-emotional aspects: 1) controlling one's anger, and 2) being with friends more comfortably [16]. Teachers' Self-regulated implementation reinforces the term learner to include anyone who is proactive in their learning efforts, is aware of their

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strengths and limitations, and is guided by personal goals and tasks [17]. So, teachers who have self-regulated abilities can direct thoughts, feelings, and actions to achieve the goals they want to achieve. In this case, the teacher will plan his learning activities to suit the targets and goals he wants to achieve.

According to X. Huang *et al.* [18] and C. Tarchi *et al.*'s research [19], the teachers' self-regulated has a significant impact on several aspects: 1) teachers' motivation, 2) teachers' self-efficacy, and 3) teacher's achievement. Positive teachers' self-regulated learning strategies tend to encourage the success of online-based teacher education and training programs because teachers will give their best efforts to complete online learning and have the potential to achieve the best results [20]. Research conducted by Andrisyah *et al.* [13] shows that the impact of the pandemic has spurred the enthusiasm of early childhood teachers to adapt to the digital learning environment. It is hoped that teachers have references to types of approaches in learning settings that encourage independent learning, such as setting goals, using effective task strategies, monitoring progress, taking notes, organizing learning, building a productive work environment, and so on [20]. From some of the quotes above, it can be concluded that Teachers' Self-Regulated is the ability of teachers to regulate the independent learning process which includes planning, implementation, and evaluation of learning, both in cognitive, affective, and psychomotor aspects to achieve learning goals.

The readiness of early childhood teachers to adapt to the digital environment is currently very much needed due to the impact of the Industrial Revolution 4.0. However, the ability of early childhood teachers in using technology in learning still needs to be honed by increasing the IT competence of teachers [15]. And to realize this, good IT experience and motivation are needed to achieve the expected learning goals in a digital environment [21]. The ability of teachers to develop plans and goals to be performed in teaching is a characteristic of teachers who have self-regulated strategies. Refer to Andrisyah *et al.*'s research [13], there are six elements for early childhood teachers to succeed in the digital learning environment, namely: 1) Goal Setting, 2) Environmental Structuring, 3) Task Strategies, 4) Time Management, 5) Help Seeking, and 7) Self Evaluation. Therefore, early childhood teachers need to instil these strategies to develop teachers' self-regulated on selves [19].

III. Research Methodology

A. Research Approach

To understand teachers' self-regulated strategy for digital learning, this study used a survey with a quantitative approach by describing the three aspects of teachers' behavioral in a digital learning environment: IT experience, IT motivation, and online self-regulated strategy (Fig. 1).

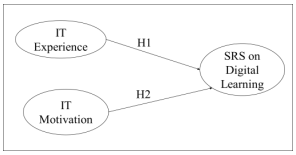

Fig. 1. Research model.

B. Data Collection

The data in this study were obtained online. Before the respondents filled out the questionnaire, we gave the participants brief instructions regarding the purpose and nature of the study. By using a random sample technique through the WA group of the teacher's community in West Java, Indonesia, this study involved 100 early childhood teachers. The following detailed information on research respondents is shown in Table I.

TABLE I: Demographic Respondent

Demographics	Category	Number of Participants	%
Gender	Female	99	99
	Male	1	1
Teaching Experience	1-5 years	41	41
	5-10 years	35	35
	>10 years	16	16
	<1 year	8	8
Certified Teacher	Yes	7	7
	No	93	93

The questionnaire was divided into 4 parts: 1) demographics, 2) the use of digital technology (See Table II), 3) the motivation for using digital technology (See Table III), and 4) the online self-regulated strategy (see Table IV).

TABLE II: List of Digital Tools

ID	Tools
1	Word Processing Apps (ex. Ms. Word)
2	Spreadsheet Apps (ex. Ms. Excel)
3	Presentation Apps (ex. Ms. PowerPoint)
4	Photo Editing Apps
5	Voice Recorder Apps
6	Video Editing Apps
7	Digital Cameras
8	Scanner
9	Digital Music (ex. MP3, I-Tunes)
10	Image Search (ex. Google)

TABLE III: Instrument of IT Motivation

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

The data collection technique used five-point Likert scale responses: 1) always, 2) often, 3) sometimes, 4) rarely, and 5) never. Data processing used Google Forms. The development of the questionnaire was validated by 3 experts with academic and practitioner backgrounds using questions that are declared appropriate and eliminating statements that were declared unsuitable. This was done as an effort to validate internally. After that, the instrument was directly used to take data from the field, and then the results were analyzed.

TABLE IV: INSTRUMENT OF SELF-REGULATED STRATEGY

No	Dimensions	Variable
1	Goal Setting	1. Formulate lesson plans 2. Formulating learning materials 3. Determining the learning method. 4. Determining learning media
2	Environment Structuring	5. Choose a teaching location that supports it. 6. Using multiple platforms 7. Using special time
3	Task Strategies	8. Doing initial apperception 9. Stimulate children
4	Time Management	10. Allocate additional study time 11. Provide time regularly
5	Help-Seeking	12. Consultation with colleagues 13. Studying material from social media.
6	Self-Evaluation	14. Doing reflection 15. Documenting the child's assessment

C. Data Analysis

In this study, descriptive statistics and inferential statistics were used for data analysis techniques. First, the analysis was carried out using descriptive analysis to determine the level of IT experience, the level of IT motivation, and the level of online self-regulated strategy. Second, the analysis was carried out using a t-test for path analysis to determine the effect of IT experience and IT motivation on early childhood teachers' self-regulated strategy on digital learning. Also, to determine the level of self-regulated of teachers, this study used the assessment criteria refer in Table V [22]. As for the data processing process using a spreadsheet tool.

TABLE V: SELF-REGULATED CRITERIA

No	Score	Criteria
1	84.2 – 100	Very Good
2	68.2 – 84	Good
3	52.2 -68	Acceptable
4	36.2 - 52	Poor
5	0-36	Very Poor

IV. RESULTS

A. Descriptive Analysis

The descriptive analysis focused on three things: 1) IT experience, 2) IT motivation, and 3) teachers' self-regulated strategy in the digital environment per dimension.

TABLE VI: IT EXPERIENCE LEVEL

ID Tools	IT Experience Level (0-100)	Status
1	61.4	Acceptable
2	49.6	Poor
3	53.4	Acceptable
4	56.6	Acceptable
5	56	Acceptable
6	53.4	Acceptable
7	58.8	Acceptable
8	47.8	Poor
9	55	Acceptable
10	64.8	Acceptable

Table VI shows that teachers' IT experience in the digital learning environment is acceptable (M = 55.68). Image Search and Word Processing Apps appear to be the highest IT experience level for early childhood teachers in Indonesia with scores of 64.8%, and 61.4%. Then, Digital Cameras, Photo Editing, Voice Recorder, Digital Music, Presentation Apps, and Video Editing Apps appear as moderate IT experience levels. Unfortunately, the Spreadsheet Apps and Scanner have a low score. All the dimension has a score of less than 70. This shows that there are still gaps related to the IT experience of early childhood teachers in a digital learning environment.

TABLE VII: IT MOTIVATION LEVEL

Dimensions	IT Motivation Level (0-100)	Status
Learn about digital technology	91.8	Very Good
Use of digital technology	89.6	Very Good
Adopt technological innovations	89.2	Very Good

Table VII shows that teachers' IT motivation in the digital learning environment is very good motivation (M = 90.2). All the dimension has a score of more than 70. This shows that there are no gaps related to the IT Motivation of early childhood teachers in a digital learning environment.

TABLE VIII: SELF-REGULATED LEVEL

Dimensions	Self-regulated Level (0-100)	Status
Task Strategies	83.4	Good
Goal Setting	83.25	Good
Self-Evaluation	83	Good
Time Management	82.7	Good
Help-Seeking	82.6	Good
Environment Structuring	77.2	Good

Table VIII shows that teachers' self-regulated strategy in the digital learning environment is good (M= 82.05%). All the dimension has a score of more than 70. All the dimension has a score of more than 70. This shows that there are no gaps related to the self-regulated strategy of early childhood teachers in a digital learning environment.

B. Inferential Analysis

The results of the t-test for path analysis on the effect of IT experience and IT motivation on teachers' self-regulated strategy on digital learning are shown in Fig. 2.

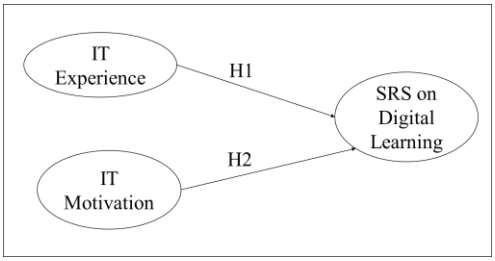

Fig. 2. Estimated teachers' SRS model for digital learning.

Fig. 2 shows that IT experience has a significant influence on early childhood teachers' self-regulated strategy for digital learning. This is indicated by the path coefficient

value of 0.1839 and t-value of 0.0216 (with a p-value of 0.05). In addition, IT motivation also significantly affects teachers' self-regulated strategy on digital learning with a path coefficient of 1.6200 dan t-value of 0.0041. The R-square value from the path analysis shows the magnitude of the influence of IT experience and IT motivation on teachers' self-regulated strategy on digital learning is 14.52%. Overall, the results of hypothesis testing using a t-test for path analysis can be seen in Table IX.

TABLE IX: THE HYPOTHESIS TESTING RESULTS USING PATH ANALYSIS

	Hypothesis	Significance
H1	IT experience → SRS on digital learning	Significantly influence
H2	IT motivation → SRS on digital learning	Significantly influence

Based on Table IX, a significant effect occurs in both hypotheses (H1 and H2). Therefore, the results of this path analysis confirm that the IT experience and IT motivation of early childhood teachers have an influence on early childhood teachers' SRS in digital learning.

V. DISCUSSION

A. Knowledge Contributions

This research has at least four knowledge contributions. First, the results of this study provide knowledge about the level of use of several tools to support teaching activities at the lower education level. The most often used tools by early childhood teachers include Ms. Word, Image Search, Digital Camera, Photo Editing, Voice Recorder, Digital Music, Presentation Apps, and Video Editing. However, the experience of early childhood teachers in using IT is still very lacking. This shows that there is a need for activities that can improve the IT competence of early childhood teachers. Because using IT in the learning process requires experience. The importance of IT experience is part of the user's desire to transform in implementing learning innovations [15, 23]. In other words, the tools used in learning activities are the usual tools used by early childhood teachers and are popular with most people. The more experienced then adapted and developed as a learning medium, the more benefits for learning will be obtained.

Second, the results of this study provide knowledge about the level of motivation to use IT in supporting teaching activities at the lower education level. The motivation of early childhood teachers in carrying out a self-regulated digital environment has looked very good in terms of task strategies, goal setting and self-evaluation. It can be said that the motivation of early childhood teachers in learning IT is also very good. This is triggered by the rapid development of technology in learning that requires early childhood teachers to be able to adapt to technology. The current pandemic condition is also able to motivate early childhood teachers to learn independently to develop their respective IT skills [13, 24]. Currently, not a few early childhood teachers can make learning videos or application-based teaching materials, which they use as interesting, interactive, and fun learning media for early childhood. However, the age factor turned out to be able to affect the motivation of teachers in improving the competence of using IT in the learning process [25]. For that, we need a way so that the motivation to use IT in early childhood learning can be embedded in all circles.

Third, the results of this study provide knowledge about the level of SRS in supporting online teaching activities at the lower education level. Effective teaching begins with how teachers can plan and create effective teaching strategies, especially for online learning. With the ability to self-regulated a good strategy can directly increase the self-satisfaction and motivation of a teacher leading to academic success [26]. The results of this study indicate that the level of self-regulated PAUD teachers in the digital environment is in a good category. This provides valuable knowledge about the emergence of hope in the development of PAUD education towards digital. PAUD teachers have realized the importance of self-regulated strategies in the online teaching process. In addition, the teachers also showed the acceleration of their adaptation to information and communication technology in supporting the teaching process. This is in line with the results of several previous studies which state that a good self-regulated strategy is proven to improve academic achievement [27, 28] and a self-regulated strategy can be used by teachers as a model or learning strategy to increase the effectiveness of the learning process in the classroom [29, 30].

Finally, the results of this study provide knowledge about the influence of IT experience and IT motivation on the SRS level in supporting online teaching activities at the lower education level. Based on Table IX, a significant influence was found in IT experience and IT motivation depending on the teachers' self-regulated strategy. That could mean that teachers' experience in IT and teachers' motivation in IT are useful to improve the teachers' self-regulated strategy in the digital environment. In addition, Fig. 2 describes the proposed model for representing the self-regulated strategy of early childhood teachers in a digital environment. It was found that the variables IT experience and IT motivation had a direct effect on teachers' self-regulated strategy in a digital learning environment. Successful promotion of educational technologies in early childhood education depends on a high level of teachers' self-regulated strategy in the digital environment [15, 31]. Teachers who have successfully online learning have good IT experience and good IT motivation. Providing more opportunities for IT training and IT awareness has a high impact on the success of the digital transformation to increase IT adoption in early childhood education [23, 32].

B. Implications for Practice

IT experience and IT motivation affect SRS and have a positive impact on early childhood teachers. IT motivation can be raised by learning, using, and adopting technology in learning. This becomes better if it is balanced with the teacher's experience in using IT. If these two things can be achieved, it will affect the SRS of early childhood teachers in terms of managing their work starting from setting goals, choosing a supportive environment for learning, setting strategies in doing assignments, time management,

help-seeking, and conducting evaluations. If this can be applied to teachers, it will have practical implications for PAUD teachers' understanding of the importance of self-regulated strategies for early childhood education innovations in digital learning environments to achieve learning goals.

The implications for schools can be input in making early childhood teacher professional development programs, for example by creating training programs or workshops. In the training or workshop, an understanding of Strategic Self-Regulated in the digital learning environment can be provided so that PAUD teachers become IT literate and have the motivation to continue learning and increase their IT experience by learning to try learning support applications in early childhood education. Because this will also have an impact on children's learning motivation, if the teacher can package innovative, creative, interactive learning, of course, the child will be interested, and happy and no one else will experience boredom in learning.

While the implication for the government is that the results of this study illustrate that IT experience and teacher motivation in using IT affect the SRS of early childhood teachers, the Directorate of early childhood education as a policy maker, can be used as input in determining what training is still needed. by early childhood teachers for them to adapt and transform in the digital environment.

VI. Conclusion

In this study, the self-regulated level of early childhood teachers in a digital environment was presented. The results of this study indicated that from a technological perspective, IT experience and IT motivation affect the level of self-regulated of early childhood teachers in the context of a digital learning environment. Thus, this study noted that both IT experience and IT motivation play a critical role in affecting teachers' self-regulated strategy for digital learning. The main contribution of this study was to provide an understanding of the importance of a self-regulated strategy for teachers toward innovation in early childhood education in a digital learning environment. In doing so, the results of this study can be regarded as a starting point for incentive future research for the successful implementation of digital transformation in early childhood education.

In addition, apart from the reported investigative results, certain limitations of this study should be noted. Respondents involved in this study only included 100 early childhood teachers in Indonesia. The self-regulated strategy of early childhood teachers in a digital environment can be measured more widely, anywhere, and does not depend on certain regions. For this reason, further research is recommended to involve early childhood teachers from various regions in Indonesia so that the respondent's domicile becomes heterogeneous.

Conflict of Interest

The authors declare that they have no competing interests.

Author Contributions

Bayu R. Aditya and Andrisyah conducted this study; Bayu R. Aditya analyzed the data; Andrisyah collected the data; Bayu R. Aditya wrote the paper; Bayu R. Aditya and Andrisyah had approved the final version.

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