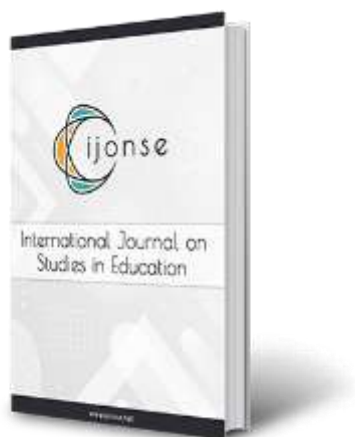




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Self-Regulated Learning of College Students toward ICT

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Abstract

This qualitative case study investigates the self-regulated learning (SRL) perceptions of university students who are encountering technology-based learning for the first time in their academic careers. Focusing on their experiences within a university-level computer technology course, this research addresses a gap in understanding how individuals with no prior exposure to technology-infused education approach and manage their learning in such environments. Semi-structured interviews were conducted with three students to deeply explore their SRL perceptions. The findings reveal that students demonstrate self-regulation consistent with the tripartite model of SRL. During the forethought stage, participants actively engaged in planning, cultivated an optimistic outlook, and activated their motivation. In the performance stage, they sustained and enhanced their motivation through the application of appropriate learning strategies, exhibiting enthusiasm for learning and employing problem-solving skills to navigate challenges. Finally, in the self-reflection stage, students critically evaluated their learning experiences and engaged in reflective activities. These results provide valuable insights into how students, particularly those with limited prior technological experience and knowledge, effectively self-regulate their learning in computer-based educational settings.

Introduction

University is one of the places where education takes place and is a place to shape professionals. A university is a higher education institution that functions to get a degree (Oxford Learner's Dictionaries, 2022). In Indonesia, a university is defined as one where all teaching-learning and administrative activities occur (Indonesian Dictionary, 2024). University could be considered a place for students to hang their dreams, aspirations, and future. Therefore, the university is a very vital environment for students. Inside the university, students do not just come for lectures, tasks, and gatherings; the university is also a means of developing talent and inculcating values. Social, responsible, and moral students will be born in the university environment. In terms of the university environment, a university has a learning system that differs significantly from a high school education level. University students must be proactive in learning activities, so they must be able to follow the existing lecture process.

In the latest curriculum of the Islamic Education Program at the university where this research was conducted, the

ICT (Information and Communication Technologies) course is a compulsory subject. However, subjects related to computers or ICT are only optional subjects for the latest curriculum at the senior high school education level (Regulation of the Minister of Education and Culture of the Republic of Indonesia, Number 38 of 2018) and also not mandatory courses in the higher education curriculum (Law of the Republic of Indonesia, No 12 of 2012). However, the Islamic Education Program continues to make it a compulsory course for students of Islamic education. A computer or ICT course is mandatory because students who continue their studies at this campus have various backgrounds, including living in rural areas and coming from traditional Islamic boarding schools, which often means they do not learn about computers or technology. The scope of this problem is critical, especially for those students in Islamic education programs who are later expected to become Islamic school teachers who can use technology in learning (Masyitoh et al., 2021).

Schools in rural areas tend to be far from technology (Arion et al., 2024; Pierce & Cleary, 2024). In the Indonesian setting, emphasis on technology utilization is an obstacle for schools located in rural areas (Kultsum et al., 2021). Furthermore, there is a recent study related to the readiness of Indonesian education to conduct distance learning during COVID-19 found that the spread of school locations in rural areas exacerbated the situation in the preparation, which was very difficult to get internet access, people who were technologically ignorance, and the lack of infrastructure owned by students (Churiyah et al., 2020). Therefore, it is fascinating to see how students with this background perceive dealing with computer/ICT learning at the university level. Lastly, we specified a study focusing on each student's SLR and struggle learning computer technology.

Technology in Higher Education

In this digital era, one of the knowledge and abilities that can support university students in lectures is utilizing or integrating technology. Some of the benefits of using technology for students include making it easier to find information and literature (Cramarenco et al., 2023), improving the ability to learn (Wahono et al., 2020), making learning more effective and efficient (Ikhlas & Dela Rosa, 2023); facilitating access to learning (Saikat et al., 2021); and increasing interest and motivation in learning (Zuo et al., 2022). Not limited to supporting lectures, competency in utilizing technology is also essential as a support for their lives after graduating from college, especially in their careers. Based on that, it is imperative to see how Islamic education programs students' strategies, methods and struggles in mastering and studying computers/ICT.

Various theories explain how a person learns and masters an ability, such as self-efficacy (Bandura, 1977), self-directed learning (Knowles, 1975), and self-regulated learning (Zimmerman, 1986). From these various theories, self-regulated learning is considered suitable for seeing the success or failure of university students in learning (Schunk & Zimmerman, 2011), meaning university students are expected. Furthermore, University students have greater autonomy and responsibility in learning (Foong et al., 2021).

Self-Regulated Learning in Higher Education

Self-regulated learning is how students become managers in learning activities (Lobos et al., 2024). SRL is an

ability where students can activate and encourage thinking, feelings, and actions that have been systematically and repeatedly planned and oriented to achieve a goal in learning (Admiraal, 2024; Zimmerman, 1990). Schunk and Zimmerman (2023) have asserted that self-regulated learners metacognitively, motivationally, and behaviorally actively participate in the learning process. Students automatically start learning efforts directly to obtain the desired knowledge and skills without depending on teachers, parents, and other people. Schunk (2023) explained that SRL takes place when students systematically direct behavior and cognition by providing knowledge, repeating information to remember, developing and maintaining positive beliefs about learning abilities and being able to anticipate learning outcomes.

SRL is a self-oriented feedback loop (Pansri et al., 2024; Zimmerman, Barry J.; Schunk, 2017). The circle contains a cyclical process in which students monitor the effectiveness of their learning strategy or method and then react to that input in a variety of ways, ranging from overt change, such as changing the use of their learning strategy (Zimmerman & Schunk, 2017; Zimmerman, 2000). The way self-regulated learners learn is at least seen from three phases, which form a cycle such as pre-action/forethought, action/performance, and post-action/reflection phases (Tinajero et al., 2024; Zimmerman, 2002). Zimmerman and Campillo (2003) explain the relationship between the three phases. The pre-action phase relates to how the learner prepares for learning, such as thinking about appropriate learning strategies, setting goals, and building motivation and interest (Bellhäuser et al., 2022; DiBenedetto & Zimmerman, 2013). The action phase relates to the learner's ability to act during learning (Zimmerman, 2013). This action relates to how learners achieve the expected goals (Zimmerman & Moylan, 2009). Self-regulated learners carry out the post-action phase with self-reflection that focuses on reflection on the result of learning and evaluates whether the expected learning objectives have been achieved (Zimmerman, 2013; Zimmerman & Moylan, 2009).

Self-regulated learning is critical in higher education, enabling students to effectively and independently manage their learning processes. Research indicates that students with well-developed SRL skills can set learning goals, monitor their progress, and evaluate their outcomes autonomously (Anthonysamy et al., 2020a). In higher education, these skills are essential due to the increased complexity of academic demands and the need for independence in managing time, motivation, and learning strategies. However, Edisherashvili et al. (2022) highlight that many students lack adequate SRL competencies, negatively impacting their academic success.

Šteh and Šarić (2020) emphasize that higher education institutions must foster learning environments that support the development of SRL, including through curricula that encourage reflection and self-management. Similarly, Guven and Babayigit (2020) reveal that students' SRL skills are often at a moderate level and require improvement, mainly through the role of lecturers as facilitators in promoting the effective use of SRL strategies. Russell et al. (2022) further, demonstrate that active learning and constructive feedback from lecturers can enhance students' self-regulation abilities. Vosniadou (2020) underscores the need for a stronger focus on SRL development during the transition from secondary to higher education. SRL development enables students to adapt effectively to more independent and complex learning environments. Thus, fostering SRL development is critical in supporting students' academic success in higher education.

In computer education, SRL plays a pivotal role due to the complexity of the subject matter and the demands of programming skills. Students must independently manage their learning processes, including planning, monitoring, and evaluating their programming performance (Shin & Song, 2022). A study by Pedrosa et al. (2017) indicates that SRL strategies such as goal setting, time management, and self-reflection improve learning outcomes in computer programming courses. Moreover, students with stronger SRL skills tend to achieve higher academic performance in programming, as they are better equipped to organize learning strategies and independently overcome challenges (Pedrosa et al., 2017).

Barak (2010) emphasizes the importance of motivation in Self-Regulated Learning (SRL) within technology education, noting that motivated students exhibit improvements in problem-solving and creativity (Shin & Song, 2022). Zheng et al. (2018) state that implementing SRL approaches in mobile-based learning environments can enhance students' learning outcomes and self-regulation skills in computer programming. Additionally, Urbina et al. (2021) highlight that technology-rich learning environments support the development of SRL skills, enabling students to cultivate more effective independent learning strategies, particularly in computer programming.

Self-Regulated Learning in University Technology Courses

Self-Regulated Learning (SRL) among students in technology- or computer-related courses is essential for supporting effective learning. In such classes, students must demonstrate high SRL skills, including setting learning goals, monitoring progress, and managing time effectively. This is particularly crucial due to these subjects' independent and often complex nature (Anthonysamy et al., 2020b). Additionally, integrating technology into learning demands that students adapt and take the initiative in effectively utilizing various digital tools and platforms (Yot-Domínguez & Marcelo, 2017).

Technology-based learning approaches, such as flipped classrooms, can facilitate students' Self-Regulated Learning (SRL), as they must study the material independently before class and use class time for a more profound learning application (Yoon et al., 2021). Furthermore, many technology/computer-related subjects are taught through blended learning or online learning, which demands a high level of SRL to ensure that students can understand the content and effectively apply practical skills (Anthonysamy et al., 2020a; Zhu et al., 2020). However, studies indicate that students often need to improve their SRL skills in technology-based learning. A key challenge is how students can remain motivated, structured, and active in developing their ever-evolving technological skills (Lai et al., 2022; Pan, 2020). Additionally, SRL is crucial in enhancing students' flexibility and learning satisfaction in distance education, which is increasingly implemented in technology-related courses (Turan et al., 2022).

It is important to note that training in self-regulated learning (SRL) for students in technology courses has improved academic performance and learning motivation, and students trained in SRL achieve higher outcomes (Theobald, 2021). Strategies such as self-reflection, effective resource management, and intrinsic motivation also significantly ensure that technology students can independently manage their learning process and succeed academically (Villatoro Moral & De Benito, 2021). Therefore, providing support and training for SRL in

technology/computer courses is crucial to enhancing students' ability to learn independently and preparing them for the workforce, which demands skills in utilizing technology and engaging in lifelong learning.

Statement of The Problem

SRL places importance on students' ability to learn the discipline of self-regulation and self-control when faced with challenging tasks. In this current study, researchers examine how university students of Islamic education programs did not have any learning in or technology integration ICT (specifically computer subjects) before entering the university. In addition, the students (n=3) in this study came from rural areas and have been schooled in rural areas. Therefore, we provide two research objectives for this current study:

1. To explore students' SRL who never attended computer courses during their pre-university learning on learning ICT/computer in university.
2. To map the three phases of SRL of students in attending and learning ICT/computer.

Method

Research Design

The study was undertaken at a privately funded higher education institution in an Indonesian district in Jambi. This institution is the center of higher education in its district. Geographically, the district itself is surrounded by many villages, which can be categorized as rural and agricultural areas (Nasution et al., 2024), and most of the students come from those areas (Badan Pusat Statistik Kabupaten Batang Hari, 2023). Furthermore, some students at this university have never encountered ICT/computer subjects during their formal K-12 education.

A qualitative design within a case study (Creswell, 2015; Stake, 2008) approach was applied to investigate the students' perceptions and strategies in a computer course where self-regulated learning is featured. The case study was selected to investigate these questions because it allows an in-depth exploration of complex phenomena within real-world contexts (Paparini et al., 2020). This approach is particularly suitable for examining diverse student experiences and strategies in technology-integrated learning environments, providing insights that other methodologies might overlook.

Relevant case studies in the Indonesian higher education context highlight the application of ICT in teaching and learning. For example, a study by Habibi et al. (2020) explored the integration of ICT among pre-service teachers in Indonesia. It found that while technological infrastructure and institutional policies are critical enablers, challenges such as limited training and resources remain prevalent. Furthermore, a case study is usually used by researchers in social science studies (Rashid et al., 2019). The case study is used to limit the study area by researchers (Paños-Castro et al., 2024) and can even be used to focus the study on a particular desired topic, such as focusing on specific events, activities, and programs (Ozernov-Palchik et al., 2022). In this regard, we focus this study on looking at students' SRL in helping them learn computers during their ICT/computer course at a specific university, targeting students who never encountered computer lessons or technology before university instruction.

Participants

This study used the purposive sampling technique to select the participants. Purposive sampling required the researcher to give criteria for selecting the sample (Campbell et al., 2020), such as 1) students taking an ICT course and 2) students who did not or lacked access to computer/ICT subjects during kindergarten to high school. The gender of the participants consists mainly of females (2). For the age they have a young age (18-19 years old). It can be said that they are Generation Z, which was born from 1996 to the end of 2010 (Benítez-Márquez et al., 2022). Technological developments strongly influence this generation (Cubukcu Cerasi & Balcioglu, 2024; Elkatmış, 2024), which tends to use technology and has no difficulty adapting to technology (Yalçın-Incik & Incik, 2022). Although two of them do not have PCs, they all have smartphones, so they are no strangers to technology.

Before we selected the sample, we distributed an online questionnaire through Google form to all university students taking the ICT/Computer course under the first researcher class. A total of 33 out of 37 students filled out the online questionnaire. The purpose of the questionnaire is to get a sample study. After that, four students were categorized as suitable sample studies, where they had never or lacked ICT/Computer lessons in their formal education before entering the university. However, only three students were willing to be interviewed. Table 1 describes the profile of the participants.

Instruments, Data Collection, and Analysis

In this study, the online questionnaire consists of personal and computer profiles. In dealing with personal profiles, we asked several questions: name, gender, age, high school, and origin place. However, regarding the distance from home to the university, researchers estimate the distance by looking at the distance from their origin place to the university in Google Maps (see Table 1). In dealing with computer profiles, we provide several closed statements, such as whether you possess a computer or not, whether you have a computer subject or both during formal and informal education, and your access level in using the computer. After that, we used semi-structured interviews with open-ended questions to gather the data. The questions follow the SRL guidelines proposed by Zimmerman (2002), which follow the three phases of SRL: forethought, performance, and reflection. Some examples of the questions are listed below:

- In the beginning, what did you think about the ICT/Computer course? Was it difficult or not?
- How did you prepare yourself for the ICT/Computer course?
- Kindly explain your learning style in the ICT/Computer course.
- How did your relationship with classmates during the ICT/Computer course?

Interviews that occurred were conducted online through Zoom meeting apps. In addition, WhatsApp chat was used for clarification in case more information was needed from the participants. The interviews were conducted using Bahasa Indonesia because it is their native language and is easier to understand. Each online interview lasted from 50-60 min. In dealing with the validity and accuracy of the data, we provided the transcript to the participants to confirm their agreement (Creswell, 2015; Habibi et al., 2021). To protect the rights of the participants, we

provide informed consent. Furthermore, we agree not to disclose their real names; pseudonyms have been used to protect their identities.

Furthermore, we listened to the interview recordings and typed them in Ms. Word as a transcript. Although we used semi-structured interviews, the transcripts obtained have not been completely mapped, so there was a need for mapping text or transcripts. Researchers used Ms. Word to make mapping or coding the text easier. (McAlister et al., 2017). We mapped the result in Ms. Word using the table feature, containing participants' statements, statement sources, and numbers (see Table 2). It is not immediately mapped out in the coding process, but there have been several sorties where each quote must meet the SLR category. Table 2 shows the final results of the data obtained.

Results

Based on the preliminary results, four students were considered appropriate participants; however, only three were willing to participate. Table 1 describes the profiles of the three participants.

Table 1. Profiles of the Participants

Personal and Computer Profiles	Participants		
	S1	S2	S3
Gender	Female	Female	Male
Age (years old)	19	18	19
High School	Islamic boarding schools (<i>Pesantren</i>)	Islamic boarding schools (<i>Pesantren</i>)	General High School
Distance from home to campus (Km)	±18	±4	±18
Program	Islamic Education	Islamic Education	Islamic Education
Have Computer Course or not (before entering the campus)			
- Formal education	Never	Never	Only one year (grade tenth)
- Informal education	Never	Never	Never
Possess a computer (currently)	No	Yes	No
- How long?	-	3 years	-
- Type of PC?	-	Desk computer	-
- Possess a smartphone?	Yes	Yes	Yes
Access level in using computer			
- At home	Never	2 -3 times a week	Never

Personal and Computer Profiles	Participants		
	S1	S2	S3
- Others (e.g., internet cafes)	Never	Never	Once a week
Computer course grade (max 100)	84.59	84.93	87.58

The computer profile shows that as long as students attended formal education before entering university, they found no ICT/computer subjects, except for one participant (S3). This student only gets one year of teaching about computers in seventh grade because the policy in Indonesia changed in the next two years, where the computer subject was optional. Based on this, the researcher included this student as the participant. The three participants were known to have never studied computers through special official courses or training. However, based on further confirmation that we did through interviews and chat sessions, only S2 has a reasonably good computer background (see Table 1). Meanwhile, S3 has an initiative towards computer learning where he accesses computers at internet cafes. Luckily, the three participants are Generation Z, who have smartphones and are familiar with existing technological developments. After that, we mapped the Self-Regulated of each participant. The Appendix presents our findings based on students' SRL in learning computer courses.

Planning Maker

Good learners are students who plan the learning activities to be carried out. The planning can be seen from the goals the students want to achieve. We got their goal in computer lectures was to be able to pass the course with a satisfactory score, an "A" grade (S1-SN2; S2-SN22; S3-SN39), or at least a "B" grade (S2-SN22). In addition, those who previously had little knowledge, still lack or do not understand at all, wanted to understand and be skilled in computer science (S1-SN2; S2-SN22; S3-SN39). It implies that students have targets to be achieved, not just attending the class.

Good Perception

In attending computer courses, students have a good perception. Students consider it important to study computers (S2-SN23; S3-SN41) and have confidence in studying computer lessons (S3-SN40). The importance of learning computer technology cannot be separated because now is a technological era where computer technology is used for work every day, and if they do not learn computers, they can fall behind (S2-SN23). Furthermore, they thought the course had an impact on the sustainability of their studies at university. The computer skills they have they believe will help them in completing their tasks, such as helping them in completing papers (S1-SN19; S3-SN56), making PPT (S1-SN19), making data (S2-SN35), and helping them completing their thesis (S3-SN56), which is a graduation requirement for undergraduate students.

The computer course benefits their study and positively impacts their career after becoming a teacher. They assume that computer technology, in general, is very helpful in their future careers, such as computer abilities will

make their job easier (S1-SN20), support good communication between teachers and students (S2-SN37), and can develop interactive and fun learning methods (S2-SN37). In addition, computer knowledge and skills will help them a lot in the future, especially when their peers, students, or families do not understand computers. They might be a tutor (S3-SN41; S3-SN52). We can see that each student has a good perception of the computer course, which is undoubtedly very helpful for them to follow the computer lesson.

Positive Motivation

Source of Motivation

In learning computers, several reasons motivate students. First is intrinsic motivation, where students think they must be able to learn computers, and the assumption is that if their classmates can learn computers, they must be able to do so (S1-SN6). Then, they liked and were interested in using computers (S3-SN43), and even interested in continuing their computer science studies (S2-SN25). Second, extrinsic motivation, such as students' assumptions about the demands in the future to master computer lessons, where computers help them in the lectures that they will do in the future and make their work more manageable in the future (S1-SN5).

Maintaining and Increasing Motivation

During the computer lecture process, both in the classroom and outside, students have experienced demotivation in learning. It can be fear (S1-SN14) and assume that he cannot master the computer (S2-SN26). However, this feeling can be overcome by the students. They motivated themselves with positive thinking like not missing the lessons (S3-SN50) and not being left behind by others (S1-SN6). This motivation can not only be maintained, but it can also be increased. Students think that computer skills are essential (S2-SN27), so they must continue to struggle to learn. After following the course, students thought that computer courses were not as scary as they imagined, thus making them feel more motivated to learn computers (S1-SN7).

Effective Strategies in Learning

Practice-based Learning

We asked about the students' learning styles, and it was different. It was found that two students generally tend to be listeners (S1-SN8; S3-SN44). However, the tendency to become a listener learner has changed when the lessons require much practice, like computer courses (S1-SN8, SN9; S3-SN45). Then, there was another student who had a tendency to do and practice as his learning style (S2-SN28).

Lastly, we can conclude that the three students have the same tendency to learn computers, such as preferring to do direct practice. Moreover, these computer lessons require many tutorials. The students usually practice due to the demands of the course, for example, doing the tasks (S2-SN29). Then, some students were used to practicing computers because they help their brothers at work (S2-SN29). Their practices are considered successful in helping them learn computers (S1-SN17; S3-SN54). This is because practice is considered easier (S1-SN17).

Using Alternative Resources

Students sometimes have trouble understanding the content when using a computer. However, those troubles could be solved by utilizing alternative learning resources. For example, in a story from S1, she ever tried to utilize YouTube as a learning tool. She used YouTube to find tutorials about computer apps, like making blogs and PowerPoint Presentations (S1-SN3). Another story from S2 and S3 is that they used YouTube and Google to learn computers simultaneously (S2-SN24; S3-SN42). They used YouTube to explore tutorials (S2-SN24; S3-SN42), while Google was used to explore theories about computer concepts (S2-SN24). It implies that those students not only rely on what is given by the lecture but also use tools that are easy for them to understand.

Peer Sharing

We explored the relationship between the students and their classmates during the interview. We found they have a good relationship with their classmates (S3-SN53). They explained that their classmates were very helpful in the class. They use this relationship to share about the lesson, like confirming the assignments (S2-SN34) and re-explaining the confused lesson (S1-SN16; S3-SN53). Notably, the students take advantage of peer sharing when they find difficulties. It is done after they try their best to learn, for example, after studying independently and using learning tools like YouTube (S1-SN16). We can imply that the students make good use of their social environment in terms of good relations with their classmates.

Positive Behavior

Students' behavior during the course looks positive. Students tend to focus on listening to lectures conducted (S1-SN15; S3-SN51). Afterward, they do not hesitate to use their gadgets to search for information related to the lesson (S1-SN15) and open learning resources (S2-SN33). In addition, Students look very diligent in attending the course. They attended computer classes without skipping anything (S1-SN13; S2-SN32).

Problem-solving learner

Problem Faced

In learning the course, students encounter several problems. Problems faced by students can come from within and outside. We found the problems that came from the students themselves, such as fear (S1-SN5, SN14), pessimism (S2-SN30), difficulties in understanding concepts (S2-SN31), and difficulties in following some parts of the practice tutorial (S3-SN48). Furthermore, we also found problems outside the students, such as not having a computer (S1-SN10) and a bad internet connection (S3-SN46).

Problem Solves

We found that the students were good problem-solving learners. Several times, students have found problems in the learning process. However, these problems can be overcome by the students. For example, when they still feel

confused in following the lesson, they try to be independent in learning, such as using YouTube, the Internet, and other resources (S1-SN4, SN12) and asking questions to others (S3-SN49, S2-SN27).

Meanwhile, when the students do not have a computer, they try to keep learning to use computer applications by using the Android/Smartphone version of the application (S1-SN11). When they have a poor internet connection, they try to use the hotspot or internet-sharing feature and look for a place with a good connection (S3-SN47). Ultimately, these students always do their best to learn and try their best to overcome the various problems they encounter.

Evaluation and Reflection

Self-Evaluation

Good self-regulated learners evaluate the development of the learning process that they have done so there would be self-improvement in the future. The students evaluate their learning process, and the evaluation is always done at every meeting (S3-SN55). In addition, they evaluated the form of self-reflection to see how far they understood the lesson (S3-SN55). If they do not understand, they repeat it until they get it (S1-SN18). Thus, we can see that students who have good SRL know how they are developing with the learning they have done, so they understand the right attitude and action they should take in the future.

Achievement

Academically, we can see how the achievements obtained by students in the computer course. The students got an excellent score, meaning they all obtained a grade higher than 80 or an "A" (see table 1). Furthermore, we explored their achievement related to their abilities. In computer courses that have been carried out, students acquire knowledge and skills. For example, some students initially cannot use various computer applications, but after taking the course, they can use various applications, such as MS Word, MS Excel, and MS PowerPoint (S1-SN1; S2-SN21; S3-SN38). The students felt that there was an increased understanding of computers, such as how computer technology developed in each era and the components that exist in computers (S2-SN21). Lastly, the students have also been able to access various alternative sources for learning from the Internet, such as repositories, online libraries, and research articles in Google Scholars (S1-SN1), and can create and post articles on blogs (S1-SN1; S2-SN21), which can be a place for the students to express their ideas and expressions.

Showing Commitment

Students showed commitment while learning computers. The commitment shown by the students is like firmness, whereby in the future, they want to use computers well (S2-SN36). Furthermore, students were committed to teach computers to those who do not understand computers (S3-SN52). With these student statements, we could imply that a good learner is committed to constantly learning about computers and wants to share their knowledge related to computer knowledge and skills with others.

Discussion

This current study explores the students' SRL in computer technology courses. The interview instrument used is expected to be able to answer questions such as how SRL helps those who have little or never had computer lessons from primary to high school in learning computer/ICT courses at university. Based on the existing theory by Zimmerman (1986), there are three phases: pre-action, action, and post-action. Figure 1 is an illustration of the SRL and how SRL helps those students learn computers. Meanwhile, figure 2 is the SRL cycle based on the findings, which aligned with the Zimmerman and Campillo (2003) scheme.

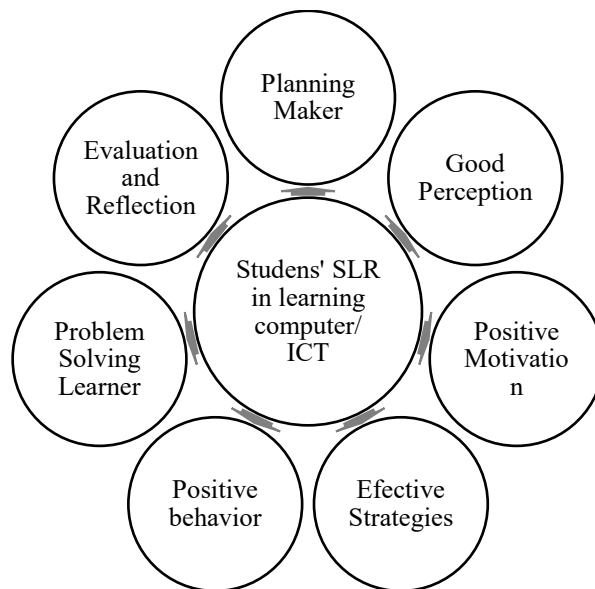


Figure 1. Possible Mapping of Students' SLR

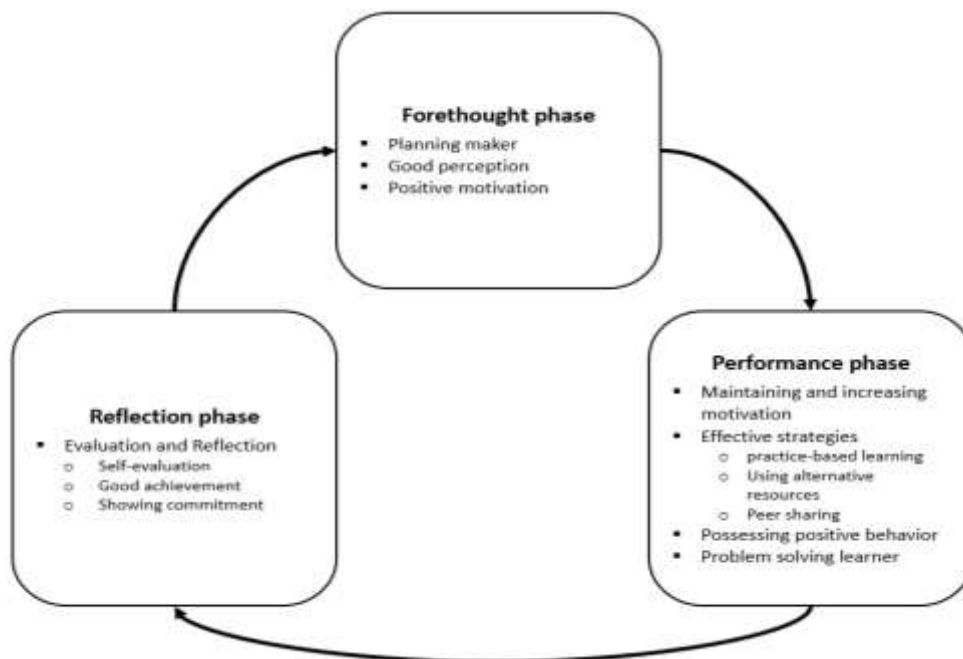


Figure 2. The SRL Cycle based on Finding

In the pre-action phase, students prepare themselves for computer courses. They make plans for the lectures that will be conducted. The students have excellent targets for computer courses, such as wanting to graduate with an excellent grade, an “A” grade. The goal setting carried out by the students is not limited to getting an excellent grade; more than that, the students target each of them to master the knowledge and skills taught in the computer course. Students with high and relevant goal-setting are indicated to have good self-regulation (Zimmerman & Schunk, 2017), which is important for students to do because it affects their success in learning (Lourenço & Paiva, 2024; Ng, 2024).

In addition, students with learning goals that are not limited to grade orientation but also focus on skill and knowledge orientation are categorized as having high SRL (Karlen et al., 2021; Teng & Zhang, 2022). Furthermore, in this planning stage, the students seemed to have positive motivation toward the computer course (e.g., motivated not to be left behind with other classmates). In the SLR concept, having high motivation in learning is very important because it could influence students’ achievement (Schunk et al., 2012; Zimmerman & Schunk, 2012). In addition to positive motivation, students also have positive perceptions when computer learning is carried out (e.g., the importance of computer learning in future life). Kaiser et al. (2020) explained that positive perception cannot be separated from the high motivation of students, and this is a component that supports students’ SRL.

In the second phase, the action phase, students have done many things. In the finding session, several categories, such as showing passion for learning, using effective strategies, maintaining positive motivation, and solving problems, can be categorized as some of the things students do when attending and doing computer lessons. The positive motivation possessed by students as their initial motivation in computer learning was found to have decreased. However, the students tried to return the motivation that had fallen back as good as before. In fact, they also tried to make their motivation much better than their initial motivation. Students who can control and maintain and even increase their motivation in learning tend to have good academic achievement (Theis et al., 2020; Ye et al., 2022).

In learning and attending computer courses, the students show positive behavior, such as diligence and focus on participating in learning activities. Liu (2022) showed that diligent students such as wanting to invest time in studying and putting more effort into learning, tend to have good achievements as well as the computer learning process carried out by the students in this study. Furthermore, positive behavior is fundamental in learning because it has an impact on the learning activities and tends to affect the success or failure of students in learning (Amerstorfer & Freiin von Münster-Kistner, 2021; Shao et al., 2024).

The students were also found to use effective strategies in learning computer technology. In this category, we put several strategies carried out by students in attending and learning the computer technology course. Those strategies include using practice-based learning as their style in computer learning, using alternative resources to support their learning activities, and utilizing peer sharing as a supplement to the learning activity. The first strategy was using practice-based learning in learning computer technology. Practice-based learning is a learning style that prioritizes practice in learning activities (Alotaibi, 2024; Choi & Park, 2023). The students in this study,

in general, have different learning styles. However, they have the same tendency toward computer learning, tending to use practice in the learning process, where learning involving computer technology tends to be successful for those who are kinesthetic or do practice (Getenet et al., 2024; Lee et al., 2024).

The second category is using alternative resources. The students do not only take advantage of the resources provided, but they utilize various existing resources to learn computer technology. Some examples of resources that they tend to use are YouTube and websites. They use websites as learning tools to seek learning resources related to more in-depth explanations of the theories or concepts they are studying. Meanwhile, YouTube is generally used by them to browse tutorials on ways to do things related to the skills that must be possessed from the output of computer technology lessons. Some studies show that YouTube can be used as a learning tool, especially for accessing tutorials (Jati et al., 2019), and tutorial videos on YouTube may help students learn (Moghavvemi et al., 2018; Zhou et al., 2020).

Meanwhile, the website may help students access learning resources (Bhat, 2023; Valverde-Berrocoso et al., 2020). Therefore, those students have utilized resources such as YouTube and Websites as well as possible in computer learning. Lastly, we put peer-sharing as the third strategy. Using peer sharing means that those students in computer learning have a good relationship with their classmates and tend to have discussions related to computer learning (e.g., confirm the tasks and explain the computer lesson to each other). Peer sharing relates to student activities carried out by one student to another, which emphasizes sharing activities such as sharing ideas and materials and learning together from the same material or assignments (Gillies, 2016; Loes, 2022; Mendo-Lázaro et al., 2018). Some studies revealed that those who tend to use peer-sharing in learning can facilitate student learning, such as increasing achievements (Graham et al., 2022; Yu et al., 2023), creating a meaningful learning environment (Tenenbaum et al., 2020; Zhang & Bayley, 2019), and promoting lifelong learning habits (Hidayat et al., 2022; Zamiri & Esmaeili, 2024).

We categorize problem-solving learners as one of the SRL categories from the students, which they tend to do in the second or action phase. In the second phase, we see that they sometimes find difficulties learning computer technology (e.g., they do not have a computer and an unstable internet connection). However, the difficulties they encountered, they could overcome in various ways that they did. That is why we categorize them as problem-solving learners. Afterward, students who could solve problems in their learning activities tended to achieve good results (Klang et al., 2021; Sari et al., 2021).

In the reflection phase, the students evaluate and reflect on the learning that has been carried out. This evaluation and reflection were carried out at every meeting and the end of the semester (e.g., reflecting on understanding the lesson or not). Evaluation is closely related to SRL, where, with evaluation, students monitor the success or failure of their learning (Imhof et al., 2024; Valenzuela et al., 2020). Those achievements attract students to continue learning, which a positive attitude in the form of a demonstrated commitment can show. The achievements that students get are related to self-reaction in the form of self-satisfaction, while the commitment shown by students is related to self-reaction, which is adaptive in learning, both of which are following the examples of attitudes and activities in the third phase, reflection phase (Zimmerman & Campillo, 2003).

Conclusion

In this study, we explore and map students' SRL based on their perception of attending and learning the ICT/computer technology class. Based on the findings, the students have self-regulation aspects that meet the three phases of SRL developed by Zimmerman (1986). In the first phase, the forethought phase, we had three activities: self-regulation, making plans, having good perception, and having positive motivation. Meanwhile, four activities were found in the second phase, the performance phase: maintaining and increasing motivation, utilizing effective strategies, being a passionate learner, and being a problem-solving learner. In the last phase, the reflection phase, the student did evaluation and reflection. This finding would be a new insight into the self-regulation that students have in computer learning; in particular, it comes from those who have never met and lack. This study would also provide new insight into students' SRL in terms of the three phases of deep empirical study. This study could be helpful for students, especially in adopting self-regulation skills and activities in learning new lessons or related to computer technology lessons. For the educator, it could be a good insight into knowing students' SRL and considering those SRL in their teaching strategy or setting class.

This study only focused on the students' perceptions. In the future, it will be fascinating if a study is conducted that does not only focus on SRL based on students' perceptions but also a study that is designed in settings to be able to see firsthand how students carry out self-regulation. Based on the findings, some respondents in this study come from Islamic boarding school backgrounds. Maybe it would be exciting to conduct a study that looked directly at whether those Islamic boarding school environments could build up the self-regulation of the learners or not. In addition, the findings in this study will be positive insight for the related governments such as the Department of Education, where students who never met or lack in computer learning but can take computer courses at universities and even tend to have exemplary achievements in lectures computer. The Department of Education is expected to be able to see the potential of students from rural areas, as shown in this study. They should pay more attention to the facilities and staff of students in rural school areas, especially in computer learning, so that there will be no too big gap between rural and urban area schools in the future.

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Ethical Considerations

The respondents provided their consent, and the data collected was kept confidential.

Declaration of Competing Interest

The authors declare that there are no competing interests to any authors.

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Appendix. Statements from the Interview with Participants

Sources (S)	Statements No. (SN)	Statements
S1	1	I can write papers, PPT, and a little about Ms. Excel, repository or blogger.
	2	I want to get an “A”, understand lessons about computers, and be able to have skills in using computers.
	3	Usually, I learn from YouTube, I learned how to create a blogger, and how to make transitions and animation for PPT.
	4	...I learn from YouTube, I find it easier to understand.
	5	I was a little scared, I was afraid to be far behind them, and I was the only one who didn’t understand computers at all, I tried to think positively. I believe this course will help me later.
	6	I am being motivated because my friends can do it, so I also have to be able to not be left behind by them.
	7	I feel more interested in learning computers because it’s not as bad as I thought in the beginning, and it also turned out to be more exciting because I was able to get knowledge that I didn’t know at all at first.
	8	My way of learning depends on the course. If there is a lot of theory, I prefer to listen to the lecturer’s explanation. However, if the courses are practical, I prefer to practice. Because it makes it easier for me to remember and understand.
	9	For computers, I prefer to go straight to practice, because that way I find it easier to understand.
	10	I don’t have laptop. I can’t directly practice what the lecturer has taught me.
	11	I usually repeat the lessons, via YouTube but for the android version
	12	Sometimes I find it difficult and there were some lessons that I didn’t understand yet, but I can understand by studying again on YouTube.
	13	I was always present in ICT courses
	14	I feel afraid and anxious, I am worried that what I was asking is not in accordance with the topic being discussed.
	15	Sometimes I listen to what the lecturer teaches, and sometimes I open my smartphone just look for little information about the lesson that the lecturer is delivering, or put it into practice.
	16	Usually, I ask my friends if I don’t understand the lesson, and also don’t understand the explanation on YouTube.
	17	I think I succeeded in the course, that’s because if you practice directly, it’s easier to understand....
	18	If I don’t understand then I will study the lesson again....
	19	In the future, it will help me, like complete papers, find literatures, look examples of

Sources (S)	Statements No. (SN)	Statements
		thesis, make PowerPoint, and etc.
	20	If I become a teacher or get another job, I will use computer, to make my work easier.
S2	21	I know more about MS Office, use blogs, Internet, websites.
	22	My target to get a satisfactory grade, I want to get an “A”, or at least get a “B”, then I want to understand more about computers.
	23	Very important, especially today, computers have become tools in daily activities. If we don’t learn computers, we will be left behind, and it will have an effect on our future.
	24	I learn computers from YouTube, because it’s easy to understand, if I want to see the theory about computer, I often look at Google....
	25	I like using computers, even I used to plan to continue my study in computer science program like my brother....
	26	My motivation is reduced (after second meeting), I was not very enthusiastic. I think, I don’t have ability.
	27	I continue to struggle in learning computers, because I need them. I also often ask my brother about computers.
	28	I’m a person who tends to practice in the learning process.
	29	For practice, in addition to assignments from the lecturer (given), I also sometimes help my brother make his documents.
	30	The problem that I found during the computer course could be that I was not too fluent/savvy in using technology. I still have to look for tutorials first, even though some of them are already fluent, so problems that arise can be resolved as well because there is an ICT/Computer course.
	31	The difficulty I face is when I learn concepts (without practice), but if I was given a task (practice), <i>Inshallah</i> (God Willing) I can.
	32	<i>Alhamdulillah</i> (Thank God), during the lectures, I never skipped computer class.
	33	Sometimes I also opened the cellphone, for example opening resources from the lecturer.
	34	With my friends, I usually ask each other. For example, asking about what tasks should to do.
	35	With this course, it really helped me to make the documents or data needed, in various courses that I will take later.
	36	I will learn a lot more about how to use a computer properly and correctly.
	37	Using computer technology is not only effective in teaching activities, but also makes it easier for students to communicate with teachers. And, it can be used to develop interactive and fun learning methods.

Sources (S)	Statements No. (SN)	Statements
S3	38	With the course, I am more familiar with technology, better know how to use laptop, writing papers, using MS Word, PowerPoint.
	39	Before taking computer course, I understand a little about using computers, and I want to understand more about how to use computers, and get “A” grade.
	40	I’m sure I can use Ms. Excel, Ms. Word, and Ms. PowerPoint, even if a little.
	41	I think computer course is important, for example, if our students don’t understand computer, we as teachers can teach them.
	42	I tried to search from Google and YouTube. I try to find tutorials, and I can follow the tutorials on YouTube.
	43	I feel motivated because I was very interested in using computers, and want to be able to.
	44	I think I’m a person who tends to listen more. Like for example listening to lectures, and the like.
	45	For the computer course, I prefer practice-based learning, because with practice we know how to use computers.
	46	The problem was bad signal/internet.
	47	I look for good internet connection like hotspot/internet sharing....
	48	In the beginning, I felt it was not difficult, but during the lecture, I found it quite difficult. For example, Ms. Word, Excel, PowerPoint, I find it a bit difficult.
	49	I try to overcome these difficulties by asking those who are more skilled, like friends or relatives.
	50	I feel motivated continuously, and that motivation can be maintained. By thinking that “I should not miss the lesson”.
	51	I am a person who tend to be quiet, focus on listening and try to understand the lesson presented by the lecturer.
	52	I understand about how to use a laptop/computer, if someone asks about computers, I will teach or tutor them.
	53	My relationship with my classmate is good. I can ask questions, especially lessons that I don’t understand.
	54	I feel successful in learning because I understand the lesson
	55	I made reflection on every meeting, for looking whether I have understood it or not.
	56	For the future, especially in my lectures, this course will make me easier, such as in making papers. Then in the final semester, there is a thesis, it will be easy too.