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A LITERATURE REVIEW ON THE EFFECTIVENESS OF SELF-REGULATED LEARNING IN E- LEARNING IN TERTIARY EDUCATION

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Abstract:

E-learning has become a common mode of learning among students of tertiary education, and self-regulated learning skills has hence become a crucial skill. This review concludes the analyses and discussions regarding the definitions and characteristics of self-regulated learning, the tools of measurement, and results of efficacy of the relevant literature, as well as investigate the personal and external factors that increase the effectiveness of self-regulated learning. Research has found that the personal factors that lead to effective self-regulated learning online mainly include goal-setting, time management, interaction with friends, and the conditions of the environment where they perform online learning. On the other hand, the external factors include the environment of the e-learning platform and the support of the tutors, specifically in the aspects of the analyses of data, design of the course structures and lessons, learning materials and virtual rewarding systems. In this study, apart from focusing on the effectiveness of self-regulated learning in e-learning, another major aim is to gather the practical measures that can be taken by the tutors and students to increase the learning efficacy of the students. Although there is controversy in some of the effective measures taken by tutors and students, they have provided additional information to the study regarding the effectiveness of self-regulated learning in e- learning, and hence will be able to provide future researchers with different perspectives to perform studies from.

Keywords: E-learning; Online self-regulated learning; tertiary education; learning outcomes

1. Introduction

With the rapid advancement of technology, informatization of education has become a common phenomenon among tertiary education systems, and e-learning has become the most direct form of education informatization (Bao, 2020). It has become a compulsory experience for university students to perform e-learning while accepting education from their universities (Fischer et al., 2022). The definition of e- learning is a process where the students learn simultaneously or separately using the web, and accepting education without face-to-face classes (Allen & Seaman, 2016). This means that the students will have more opportunities to obtain information via e-learning. As compared to the traditional face-to-face lessons, the limitations of time, physical space, and materials are inexistent in e-learning, giving the students massive autonomy over their learning times, contents, and methods (Cunningham & Billingsly, 2003). At the mention of its nature, the students' increased autonomy in their learning processes indicates that they've escaped the structured and planned learning spaces and contents of traditional classroom lessons, and the goals of e-learning will hence be highly student-centered.

In consideration of the major characteristics of students of e-learning, factors such as self-regulating skills, goal setting skills, self-discipline, time management, and appropriate help-seeking will affect the effectiveness of e-learning (Cazan, 2014). Among them, latest studies have shown that self-regulation is a crucial condition in e- learning, and that it is a basic requirement to ensure highly effective e-learning as well (Qian & Song, 2021). At the same time, self-regulated learning (SRL) is considered as an important skill in e-learning. That is because students who are able to self-regulate well will have more opportunities in learning effectively, and they will end up having higher overall satisfaction throughout the learning process as well (Lim et al., 2020; Zalli et al., 2019). In other words, the flexibility of e-learning and the autonomy over the learning process in e-learning requires the students to utilize self-regulated learning skills well. Under such circumstances, most of the students have not realized the importance of self-regulated learning, and do not have solutions to effectively setting learning goals, self-monitoring their own learning process, and evaluating their learning outcomes yet (Zhao & Chen, 2016).

Moreover, upon further investigation regarding e-learning, more and more researchers have been paying attention to the effectiveness of Online Self-Regulated Learning (OSRL). Nevertheless, the existing studies are focused on aspects such as the concepts, affecting factors, learning motivations, and strategies of self-regulated learning (Albelbisi & Yusop, 2019; Emin & Karaca, 2021; Wander & Imbriale, 2017). Therefore, the aim of this literature review is to provide a detailed perspective of analysis to measure the effectiveness of self-regulated learning in an e-learning environment in tertiary education. Not only will the concept of self-regulated learning be investigated, the affecting factors of self-regulated learning in e-learning will be resolved as well, including the development of the e-learning environment, the interactions and influence between peers, the use of regulating strategies, and the quality of the courses. A review regarding the effectiveness of performing OSRL will be performed from both the perspectives of the students

and tutors, and the quality of the tutoring of the tutors as well as the learning outcomes of the students will be evaluated.

2.0 A Literature Review of Online Self-Regulated E-Learning

2.1 Self-regulated learning

SRL is the process of self-guiding, where the students turn their own thinking skills into learning skills (Zimmerman, 2002). In the process of self-regulated learning, the students adapt their knowledge, motivation, behavior, and emotions in an organized manner as they strive to achieve the goals of their tasks (Zimmerman & Schunk, 2011). According to the study model of Schunk and Zimmerman (1988), self-regulated learning can be divided into three stages. The first stage is forethought, where the students design their learning plans according to the goals of their tasks beforehand. The next stage is performance, where the students monitor the execution of their learning plans and the progress of achieving their goals, then make amendments to their learning plans accordingly. The third stage is reflection, where the students evaluate and reflect on the execution of their learning plans and behavior to improve the learning outcomes. Based on the contents of the three stages, the students implement the different stages of self-regulated learning repeatedly, and every stage is able to show effect on the next stage.

With that, self-regulated learning holds three significant characteristics, with the first being the students being active participants in their learning processes, the second being the students owning the ability to control the aspects of their learning processes, and the third being the students performing self-evaluation and reflection according to the aims of their tasks. In the environment of traditional face-to-face classes, those who have strong SRL skills are usually considered as high-quality learners by researchers and educators (Boekaerts, 1999). That is because they're able to participate in and monitor their own learning processes through their metacognition, motivation, and behavior, and be fully responsible for their own learning outcomes (Zimmerman, 1989, 1990). Similarly, researchers have emphasized that e-learning provides students with a high amount of autonomy and minimal monitoring by tutors, hence requiring them to perform self-regulated learning (Deng & Zhou, 2018; Lehmann et al., 2014). In other words, the learning outcomes that the students will achieve under the e-learning environment are highly dependent on their self-regulated learning skills.

2.2 The Basic Characteristics of Self-Regulated Learning in E-Learning

As the amount of learning resources on e-learning platforms become abundant, researchers have begun to prioritize research regarding SRL in e-learning environments. In e-learning environments, whether the students are able to achieve academic success or not is highly dependent on their self-regulated learning skills. That is because the students are given more autonomy on their learning processes (Xu & Jaggars), and hence require stronger self-management skills (Beishuizen & Steffens, 2011). Ejubovic and Puška (2019) pointed out that the students are under restrictions of the e-learning environment. They have to plan, structure,

monitor, and evaluate their own learning processes, and participate in self-regulated learning actively. To be precise, with the minimal presence of tutors in e-learning systems (Broadbent, 2017; Wong, Baars, et al., 2019), the students have to make judgements and adjustments according to the traces in their learning processes, and decide on the different methods of dealing with their learning materials before exerting their self- regulated learning skills effectively. Research has found that the stronger the OSRL skills of a student is, the more evident his exploration skills on the web is, as well as his motivation towards specific tasks and self-efficacy (Cho et al., 2017).

2.3 The Measuring Tools of Self-Regulated Learning in E-learning

Most of the researchers have used the SRL model as the theoretical framework of the development of the tool, which is usually to explain the concept of self-regulated learning and measure the impact of self-regulation on the learning outcomes of the students. The researchers weren't able to explain the exact effectiveness and worth of self-regulated learning that the tool supports (Jivet et al., 2018; Perez-Alvarez et al., 2022). Thus, to reduce the incompatibility between the tool and the evaluation, this study will only investigate the OSRL measuring tool, and only report the findings by the research tools that have been used to investigate the detailed effectiveness of self- regulated learning.

The questionnaire regarding self-regulated learning in e-learning was created by Liu (2018), and was completed based on the three-stage theoretical model of self- regulated learning of Schunk and Zimmerman (1998). The questionnaire consists of contents of six dimensions, with a total of 37 questions, including 6 goal questions, 8 self-motivation questions, 7 task strategy questions, 9 self-monitoring questions, 3 help-seeking questions, and 4 evaluation and reflection questions. The questionnaire uses a Likert Scale from 1 (Strongly disagree) to 5 (Strongly Agree). The higher the marks, the stronger the student's self-regulated learning skills in e-learning are supposed to be. The Cronbach's alpha value of this questionnaire in Liu's (2018) study was 0.96, with the various dimensions including goal setting, self-motivation, task strategy, self-monitoring, help-seeking, and evaluation and reflection having Cronbach's alpha values of 0.88, 0.89, 0.85, 0.88, 0.80, and 0.86 respectively. This indicates that the contents of the questionnaire are reliable, and that the dimensions involved are consistent.

Apart from that, there was an online self-regulated learning questionnaire (QLSQ) that had been sufficiently validated and frequently used. This questionnaire was created by Barnard et al. (2009). The aim of creating this questionnaire was to evaluate the changes of the students' self-regulated learning skills in an e-learning environment, and provide crucial information regarding the students and their learning environments. The questionnaire consists of 24 questions, including questions of six dimensions. The contents of the dimensions include goal setting, structure of environment, task strategy, time management, help-seeking, and self-evaluation (Barnard et al., 2009). The questionnaire uses a Likert scale from 1 (Strongly disagree) to 5 (Strongly agree). The Cronbach's alpha value of the scale results was 0.90, with the Cronbach's alpha values of the dimensions ranging from 0.67 to 0.90, meaning that this questionnaire is sufficiently reliable.

The truth is that according to the literature review by Perez-Alvarez et al. (2022) on the measuring

tools of self-regulated learning in e-learning environments, most of the OSRL tools do not evaluate the relationship between the process of self-regulated learning of the students and the function of the tools. This is the main reason why only findings of OSRL questionnaires that have been validated for their functions have been chosen to be reported. Upon the analysis of the measurement contents regarding online self-regulated learning of the two questionnaires, it is clear that goal-setting, task strategy, help-seeking, and self-evaluation are key contents of OSRL. That means that the report regarding the effectiveness of self-regulated learning in e-learning should be focused on goal-setting, task strategy, help-seeking, and self-evaluation.

2.5 The Effectiveness of Personal Factors that Affect the Effectiveness of Self- Regulated Learning in E-Learning

As compared to the traditional learning environment, the special traits of the e- learning environment include the lack of guidance from tutors and flexible learning hours, which makes the SRL skills of the students extremely important (Kizilcec et al., 2017). Something that is worth paying attention to is that most students do not begin self-regulated learning in e-learning environments on their own initiative, or are not able to perform them with high quality. They have to be cultivated or trained to do so. Therefore, to measure the effectiveness of SRL well, understanding about access to the online courses is crucial, as well as how to satisfy the needs and approve of the experiences of the students who are compatible with the contents and plans of the lessons. Zhang et al. (2022) came up with a conclusion that students who participate in online learning who have experience in participating in online courses that have been provided officially by their schools have the highest quality of self-regulated learning. This means that with the students' past experiences in online learning, they're more familiar with the e-learning environment, and are hence able to utilize the e- learning tools and resources skillfully (Rodrigues et al., 2008). In other words, if the students want to improve the quality of their OSRL, they'll have to be more familiar with the use of e-learning tools and other relevant resources.

To better understand the learning process of the students during SRL, the details of the learning activities and functions of the e-learning platforms have to be considered, as well as the evaluation of their performance during the lessons. To be exact, when the students focus their goals on improving their data science skills and knowledge, and not set goals involving external success, the quality of their OSRL tends to be higher (Littlejohn et al., 2016). Moreover, the students have to ensure a suitable amount of e-learning time. Santoso et al. (2022) explained that students who spend 3-6 hours of time on fully attentive e-learning per week have better results than students who spend more or less time on e-learning. The reason is because they have better time management skills in OSRL. With that, it can be concluded that goal-setting and time management is critical to maximize the effectiveness of self-regulated learning (Bai et al., 2021).

In usual circumstances, setting goals and time management are known as basic behavior of SRL, as the subsequent plans are carried out based on them. As time passes, self-monitoring becomes an important part in e-learning, as they'll be able to observe their own learning processes through monitoring. A study of Mou (2021) has proven that students who are able to self-monitor during

their learning processes have reported to have spent more time on learning as compared to the previous week, with the reason being because they've developed higher self-standards. Besides that, the students were able to accept feedback from their tutors and peers, and were able to acknowledge their flaws in the process of self-learning, then try to make adjustments to achieve better results (Mou, 2021). This shows the positive impact of SRL on the students, and shows that the mentioned behavior is effective in the e-learning environment.

Apart from that, studies have proven that students have not been utilizing group study strategies sufficiently (Broadbent, 2017). The researchers believed that reasons such as lack of emotion of students in the e-learning environment has led to the increased difficulty of them learning with their peers interactively (Schumacher, 2019). This means that group study plays a significant role in providing motivation to the students in self-learning online. A study has shown that a group study environment is able to let the students evaluate their own learning progress against other real examples. By participating actively in the learning processes of their peers, the students are able to implement appropriate group study strategies (Hussain & Al Saadi, 2019), and hence increase their satisfaction in their learning outcomes. Therefore, to have better OSRL skills, students should interact with their peers more throughout their learning processes. That's because effective interactions with their peers will aid in improving their own understanding towards the contents of the lessons and obtain new knowledge.

Selective attention plays a huge role in avoiding distractions and ensuring focus in an e–learning environment (Dayan et al., 2000). That means that in an e-learning environment, students have to understand the states of their own attention spans clearly, as well as the strategies that can be taken to regulate their attention effectively. To focus well in an e-learning environment, students may close irrelevant tabs, ban the use of the internet, reduce the uploads and downloads of contents, or postpone interrupting tasks to create an ongoing and uninterrupted learning environment (Wu, 2017). Furthermore, the researcher Wu (2017) has stated that students may work hard to increase their motivation to improve their focus so that they wouldn't be affected by feelings of guilt. The truth is that emotions are commonly neglected by the students in the e-learning process. Hara (2000) mentioned in her study that frustration, loneliness, anxiety, and confusion are emotions that appear the most frequently in the e-learning process of students. Nonetheless, researchers have suggested that students pay more attention to positive emotions while performing e-learning, and minimize the negative emotions to improve their self-regulated learning outcomes (You & Kang, 2014). Therefore, in an e-learning environment, the students have to have good management and control over their emotions so that they're able to utilize the SRL strategies better to achieve their learning goals.

2.6 The Effectiveness of External Factors that Affect Self-Regulated Learning in E-Learning

For the students to achieve effective self-regulated learning, not only will the students have to support it with personal factors, they will require the support of the e- learning environment as well. In the study of Mahmud and German (2021), a student reported that reliable internet

providers, stable and portable connections, and comfortable e-learning spaces are able to ensure the effectiveness of their self- regulated learning processes. Nussbaumer et al. (2014) pointed out that through providing an open e-learning environment by preparing personalizable and customizable platforms, students will be able to create their own learning environments by choosing their preferred learning tools, and hence be able to conduct SRL better. Apart from that, the guidance provided in the e-learning process will let students with more prior knowledge achieve the best learning outcomes, while the guidance provided will be more effective in aiding the students with less prior knowledge (Yeh et al,. 2010). This means that different types of guidance will affect the way students of different capabilities use SRL strategies. The structures of the e-learning environment should be developed according to the evaluation data of the platform while providing personalized support to the individuals. Just as Baker and Siemens (2014) has explained, the aim of using complicated methods to obtain the data is to monitor the participation and activity of the students in the e-learning platform through their digital footprints to understand and improve their learning experience.

Similarly, research has shown that tracking data saved in the e-learning platform may be used to investigate the self-regulated learning processes of different students by observing their self-monitoring abilities in the process of self-regulated learning (Jansen et al., 2022). In addition, researchers have also used a visualization dashboard management interface to track the learning trajectories of the students, hoping to improve the self-learning awareness of the students (Pérez-Álvarez et al., 2018). In fact, not only are they monitoring the learning activities of the students, they are helping them manage their time effectively as well. Most researchers emphasized that time management is a key factor in predicting the effectiveness of the university students' online self-regulated learning (Bai et al., 2021; Broadbent, 2017; Kizilcec et al., 2017), and recommended that tutors implement more targeted support measures to improve the time management skills of students. For example, they may require students to use a diary, note down their weekly learning plans, create task lists for tasks with different priority levels, and set their short term, medium term, and long-term learning plans (Broadbent, 2017). Furthermore, the tutors may provide regular feedback based on the progress of students' weekly projects, suggesting specific areas for improvement and detailed comments on the projects. The time management skills of the students will hence be improved (Mou, 2021). In other words, through timely and targeted feedback from teachers, not only will the students' time management skills be strengthened, their self-regulated learning skills will be improved as well.

As for the support provided through lessons, it will require teachers to design the courses carefully to attract the students and provide them with a positive learning experience (Schultz & DeMers, 2020). In the study by Wong, Khalil, et al. (2019), SRL prompt videos were embedded into the design of the course, with three questions about planning, monitoring, and reflection in each video. The study showed that the students who watched the SRL prompt videos engaged in more of the course activities as compared to the non-viewers, and they also had higher frequencies of interaction in each of the course activities (Wong, Khalil, et al., 2019). Moreover, the tutors divided a learning topic into multiple sub-questions in online learning forums, then activated more

detectors, and produced timely comments on the posts of the students to stimulate interaction and discussion among peers (Zhu et al., 2020), as well as enhance their awareness regarding peer interaction. Specifically speaking, building group studying frameworks, such as dividing students into "heterogeneous" groups, will allow the group members to question, complement, and help each other, thus promoting purposeful interactive dialogues regarding the contents of the lessons (Bai et al., 2021). To be exact, the tutors may also provide the students with feedback through various multiple-choice modes to train their reflection and reasoning skills by requiring them to complete problem-solving exercises. (Pardo et al., 2016). Therefore, tutors may improve the self-regulated learning skills of students by embedding SRL support measures into the lessons (Jansen et al., 2020; Jansen et al., 2022).

It is worth noting that in order for students to engage in effective online self- regulated learning, the tutors need to provide them with clear learning materials. A researcher reported that tutors should prioritize appropriate explanation and interpretation of the learning materials upon delivering the materials to the students, otherwise the students may have insufficient understanding of the learning tasks assigned by their tutors, which will hence increase their difficulty of understanding the contents of the learning materials (Mahmud & German, 2021). In other words, without effective teaching support and material explanation from the tutors, the students are likely to overestimate their ability to understand the learning materials (Baars et al., 2018), which may have a negative impact on their subsequent self-regulated learning processes. Throughout the process of execution, the tutors may provide the students with individualized guidance on learning methods, feedback and adjustment suggestions on learning tasks, and answers to their questions.

In addition, when it comes to external support for the ORSL of students, digital badges that are used to support the e-learning environment have to be mentioned. Digital badges are known as a form of reward-based external support for OSRL. They’re typically used to validate the students’ achievements in completing their learning tasks. Some researchers believe that digital badges can provide positive reinforcement for certain learning behaviors of students, as they may share their digital badge achievements with their peers (Lim et al., 2020). To put it another way, providing virtual achievement rewards for students in e-learning environments may enhance their self-efficacy. The researcher Zhou et al. (2022) has confirmed that self-efficacy has a positive impact on OSRL as well.

2.7 Effective Feedback for Self-Regulated Learning in E-learning

Through online learning, most students have experienced significant changes in their ways of acquiring knowledge. As for self-regulated learning, whether through students' personal factors or external support, the ultimate goal is to better help the students achieve effective online self-regulated learning. Cai et al. (2020) explained that feedback is essential to achieve the goal of "learning and assessment integration", and it is crucial to ensure the quality of online learning. In fact, the development of online courses should be focused more on the diverse evaluation and feedback on the students' learning experience and e-learning environment support for effective

e- learning, rather than just evaluating the results of self-regulated learning. Therefore, this study believes that effective feedback for online self-regulated learning should be in accordance to the principles of timeliness, specificity, diversity, and goal orientation. Broadbent et al. (2021) emphasized in their study that assessment and feedback should be formed specifically based on the SRL characteristics for online students, as it will help to understand the type of support students need. Students who lack self- efficacy, have ineffective time management, and have difficulty persisting in tasks or formative assessments require more effective assistance (Broadbent et al., 2021). As the researchers Baars et al. (2018) have pointed out, it is crucial for tutors to provide effective teaching support and material explanation support. If students lack support or feedback from tutors, it will likely affect their subsequent learning outcomes and self- regulation abilities. That is to say, tutors should give students targeted feedback regularly and point out the shortcomings of the progress of their weekly projects in time, as well as provide detailed improvement suggestions (Mou, 2021), so that they can better achieve their task goals. At the same time, according to a study by Yeh et al. (2010), different types of online prompt feedback should be provided to students with different prior knowledge levels in different majors during the online learning process, with predictive prompts for students with higher prior knowledge levels and reasoning prompts for students with lower prior knowledge levels.

In the online learning environment, students are in control of their own learning. The lack of self-regulated learning abilities in e-learning is mostly due to insufficient internal and external feedback. Cai et al. (2020) suggested that students need to effectively the internal resources, such as the support of tutors and learning tools, use online learning tracking data to perform appropriate evaluation and summary, promote the transformation of external feedback to internal feedback, and create sharing and learning activities between the students, tutors, and their peers to increase effective feedback, thus improving the quality of their online self-regulated learning. Moreover, Davis et al. (2016) emphasized that tutors should provide timely, specific feedback to students to encourage them to reflect and self-regulate, and the study has found that such feedback is able to significantly improve learning performance and engagement of the students.

3. Summary of the Review

In the process of self-regulated learning, students automatically activate their cognition, motivation, behavior, and emotions to achieve their goals (Zimmerman & Schunk, 2011). In the context of online learning, most researchers believe that the online self-regulated learning (OSRL)process of students is the process of combining their learning skills and beliefs to achieve task goals. Researchers mainly investigate the quality of the OSRL of the students from dimensions such as goal setting, environmental construction, time management, task strategies, seeking help, and self- evaluation (Liu, 2018; Mahmud & German, 2021; Santoso et al., 2022; Ulfatun et al., 2021). However, most studies aim to understand the various aspects of OSRL instead of help students plan, self-monitor, and reflect on their learning activities, and do not provide specific practical guidance to tutors on how to enhance the OSRL process of students (Viberg et al., 2020).

Furthermore, in studies regarding the OSRL process of students, researchers often use questionnaires to investigate students' self-regulation abilities (Liu, 2018; Santoso et al., 2022). In addition to using questionnaires, researchers also use tracking data based on learning trajectories of the students to delve deeper into their learning trends and self-regulation awareness (Cai et al., 2020; Jansen et al., 2022; Pérez-Álvarez et al., 2018). Process analysis is then performed to create self-regulation process models of students and distinguish them into different clusters, including ordinary regulators, help-seekers, self-regulators, and weak regulators (Jansen et al., 2022). Clearly, this approach aims to better understand the changes in the behavior of e-learning students so that SRL interventions can be provided through the design of the course structures to improve the' online self-regulated learning abilities of the students (Jansen et al., 2020; Jansen et al., 2022). In addition to background characteristics such as age, gender, and family background, researchers pay more attention to the impact of learning motivation (Pelikan et al., 2021), self-efficacy (Santoso et al., 2022; Ulfatun et al., 2021; Zhou et al., 2022), peer interaction (Bai et al., 2021; Hussain & Al Saadi, 2019; Lim et al., 2020; Schumacher, 2019), and self-monitoring (Jansen et al., 2022; Mou, 2021) on online self-regulated learning. Most studies are focused on the factors that influence OSRL to compare the outcomes affected by different factors, which can not only help understand the effectiveness and applicability of the different stages of SRL, but also provide more specific recommendations for students and tutors to optimize the' learning experiences of the students and teaching effectiveness of the tutors.

Regarding the research results on online self-regulated learning, the researchers mainly focused on validating its effects on learning outcomes (Broadbent, 2017; Cazan, 2014; Santoso et al., 2022) and satisfaction with online learning (Ejubovic & Puška, 2019; Lim et al., 2020). In e-learning environments, the effectiveness of the self- regulated learning processes of students and academic satisfaction are mainly presented in regulation strategies, learning motivation, self-regulating skills, learning attitudes, learning engagement, and goal achievement. During the process of e-learning, if students are able to fully perceive their satisfaction in various aspects, they will be able to use more self-regulated learning strategies, which will greatly enhance their thorough understanding of knowledge and skill construction. Then, true learning will finally occur.

In addition, studies have also focused on demonstrating the effectiveness of OSRL from the perspective of tutoring practice. Jansen et al. (2020) divided students into experimental and control groups. The experimental group was provided with multiple course content modules, and they were required to complete workbook exercises, and watch videos and learning materials in stages with a deadline for completing the tasks. All of the content modules were ended with a test of the complete contents of the module. The purpose of this approach, according to the researchers, was to help standardize the learning behavior of the students. Other researchers analyzed the learning attitudes and will of persisting of students while performing e-learning from the perspective of self-regulated learning, and required them to attend lectures and tutorials, submit written papers and group reports, as well as complete online forum learning interactions at the same time (Zhu et al., 2020). It is worth noting that among the studies that investigated the quality of online self-regulated learning, all of the researchers self-reported that there were limitations in the sample

sizes, target population, learning environments, and the effectiveness of students' self-monitoring (Wong, Baars, et al., 2019; Zhu et al., 2020). This means that in e-learning environments, implementing SRL teaching practices for students requires a balance between intervention support and respect for the students' autonomy so that the students can truly benefit from self-regulated learning support.

4. Progress of Research and Insufficiency

Although this study analyzes the effective measures of OSRL from the perspectives of both students and tutors, from a more comprehensive review perspective, there are still many limitations and urgent problems that need to be addressed. Most researchers used questionnaires to complete surveys, while some used tracking data to track learning trajectories to investigate the issues, and a very small number of researchers use both questionnaires and experiments to conduct research. The research methods are incomplete, which can directly affect the generalization of the research results. At the same time, there is almost no study focused on different types of students, and researchers generally focus on undergraduate students, rather than students with other educational backgrounds. There is also little attention paid to student groups with different majors and cultural backgrounds, which requires expanding the scope of research object samples.

The most noteworthy thing is the lack of in-depth research on specific implementation strategies and methods to increase the effectiveness of online self-regulated learning. Specifically, most researchers pay more attention to the learning effectiveness of the OSRL process of students, and the vast majority of research conclusions evaluate the effects of the SRL processes of the students. However, barely any effective and actionable self-regulated learning strategies have been mentioned. Similarly, there is a lack of specificity in the teaching practices of the tutors. Although there are still many problems and challenges in the research on the effectiveness of online self-regulated learning, conducting a comprehensive literature review focused on its effectiveness has also provided additional progress to the investigation of the effects of OSRL to a certain extent, which will benefit both tutors and students.

5. Conclusion

The truth is that most of the studies on online self-regulated learning is conducted from a perspective of the big picture. Even though most researchers investigated the interactions between various stages based on the SRL theoretical model, there is still a lack of a micro perspective. Through a review of OSRL research, it has been found that a large amount of research has explored the learning effectiveness and influencing factors of online self-regulated learning, which to a certain extent, demonstrates that a macro research perspective is more productive and generalizable. This study collected viewpoints and materials on the effectiveness of OSRL from the perspective of students' personal behavior and external support with the aim of providing more specific suggestions for online self-regulated learning. Not only will the students be provided with practical learning methods, the tutors will be provided with operational and instructive teaching

suggestions as well.

The findings of this study provide directions for future research. Online self- regulated learning should not only be aimed at tertiary education online environments, but be expanded to environments with larger research sample sizes, such as high schools, middle schools, and elementary schools as well. Although this study specifically reviews the limitations of online self-regulated learning in higher education environments and confirms the effectiveness of the self-implementation of personal factors of students as well as the external support of tutors for OSRL, it may become a controversial issue and even lead to conflicts in terms of effectiveness and teaching quality. Nevertheless, using more goal-oriented research methods will help to elucidate the implement ability and generalizability of the effective measures and provide more diverse perspectives for future research on online self-regulated learning.

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