Review

Self-regulation and Peer Collaboration among Students of Higher Education in Digital Learning Space: A Systematic Literature Review of JCR High Impact Factor

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Abstract: In this unprecedented era of computer-supported and distance learning, it is critical to rethink the way students are supported through vital skills like self-regulation and peer collaboration. A variety of digital media has emerged, allowing learners autonomy while requiring the ability to effectively regulate different components of the educational process for long-term academic success. We reviewed collaboration, communication, and self-regulation in digital learning environments as part of online learning. We discussed how these abilities are reflected in highly cited content. High-impact factor studies were identified using advanced software Herzing Publish or Perish to retrieve highly cited research publications metrics. The search resulted in 272 records from 2010 to 2022, 192 duplicates were identified to remove and 48 JCR articles were shortlisted for review. We examined and reflected on sufficient connections to make firm judgments about correlations of concepts. The review identified prominent themes surfaced in the high impact factor academic publication e.g., digital learning environment, interaction, engagement, feedback, self-efficacy, motivation, meta-cognition, achievement, technology, blended learning, and orientation of ICT. Many studies support different features of SRL & PCL through different tools, access to educators or feedback, encouragement, and through peers. However, all of them discuss the processes that students use to self-regulate learning in these situations. It is suggested to examine whether the effectiveness of certain SRL processes varies by online learning mode.

Keywords: Self-regulation, Peer collaboration, online learning, communication

1. Introduction

In recent years, the concept of traditional education has undergone fundamental changes. Being in the classroom is no longer the only learning opportunity, at least with the rise of the internet and new technologies. Today, as long as there if you have an internet connection, you can enjoy quality education anytime, anywhere. We are now entering a new era of the online education revolution. In this unprecedented era of digitalization and distance learning, it is critical to rethink the way students are supported in their learning process. While self-regulated learning (SRL) is also associated with conventional forms of education, digital education increases the importance of SRL even more apparent [1-2]. Self-control is not a personality trait that comes naturally to everyone. It is a process of learning that must be continually nurtured and promoted [3]. Many have looked for self-regulation teaching strategies or role models as a result. In addition, there is an increasing demand for lifelong learning. Online Learning (OL) provides a never-before-seen application of this notion in this situation. In fact, digital learning makes it feasible to combine the benefits of customization, restriction, and personalization [4], [5]. It does, however, mark a substantial shift in how students and teachers operate [6]. The importance of SRL becomes even more important than the direct supervision and guidance of teachers as a determinant for the successful implementation of the learning process and improved academic performance of students, which is common in many forms of distance learning

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[7]–[9]. It is essential that learners must actively participate in planning their own learning paths, setting goals, using the best strategies to achieve those goals, monitoring their progress, reflecting on their learning, and adapting as necessary [10]. It has been established that students' learning challenges are brought on by their inability to self-regulate and function well within contemporary educational norms and conditions [11]. For example, a significant gap between the enrollment and completion rates in Massive Open Online Courses (MOOCs) is another illustration of the significance of the support that distant learners require [1].

1.1 Self-regulation in Online Learning at Higher Education

In higher education, SRL is even more crucial as coursework gets harder and more complicated [12]. Even before COVID-19, higher education was shifting towards online study, and it is currently moving more quickly. Additionally, the distance learning paradigm is anticipated to persist the longest beyond COVID-19 at the higher education level [13]–[15]. Over the past ten years, there has been an enormous shift in the way that education is delivered, particularly at the higher education level. Diverse digital learning tools are now available that promote learner autonomy while also necessitating effective regulation of a number of learning-related processes in order to ensure long-term academic success. Digitalization and the shift to distant forms of operation have had a profound impact on how people live, study, and work in the twenty-first century [16], [17]. However, COVID-19's emergence sparked a massive "online movement" in education and an even bigger, irreversible reliance on digital technology in general. OL is becoming more and more common, and following the COVID-19 epidemic, it will eventually become the new norm, according to current educational trends [18], [19]. As a result, the field of education is beginning to adjust accordingly and come up with new strategies to deal with the new trends [20], [21]. The transition to distance learning is particularly evident and more commonly used at the higher education level in the field of education.

It is believed that SRL consists of a number of different parts, including metacognition, cognitive strategy management, and behavior [22]. It consists of all cognitive functions that enable the learner to direct their behavior, motivation, and metacognition to learn and make choices about how to enhance learning [23]. Students that participate in SRL use a variety of techniques to complete academic work [24] during the many stages of learning, primarily to organize, track and evaluate learning [25], [26]. SRL highlights the value of learner autonomy and calls for self-evaluation and self-awareness of the academic strengths and limitations of the learner [27].

1.2 Peer Collaboration and Digital Communication

Peer-to-peer learning and group learning are both forms of collaborative learning [28]. Peer learning, often known as peer mentorship, is a type of cooperative learning in which students exchange ideas or solve issues in pairs or small groups [29]. Digital involvement, cooperation, and communication encompass attitudes and actions related to collaborating online [30]. Digital communication offers a number of advantages, including the capacity to interact with people around the globe and the potential to communicate more effectively and efficiently while yet reaching vast audiences with little effort [31]. This skill facilitates engagement in communities and online networks through ethical awareness and global citizenship, as well as the exchange of information and messages via digital collaboration tools for personal and social goals [32], [33]. For instance, interactions between students and the material, between students and teachers, and between peers are made possible by online learning [34], [35]. Digital tools and global technology, however, can be ineffectual if they are not meaningfully integrated into teaching-learning processes.

Online education has seen a rise in the popularity of collaborative learning. Online collaborative learning has unique characteristics that set it apart from face-to-face interactions, such as the presence of students who are geographically separated from one another and the promotion of collaboration through computer-mediated communications. These exercises have been described as highly self-regulatory learning exercises, emphasizing the crucial part that SRL plays in effective online learning [36]. Many learning

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management systems have educational technologies that offer to track student learning and provide adaptive scaffolding, such as online quizzes with automatic feedback and learning analytics tools to identify log patterns [36]–[38], this might enhance pupils' ability to regulate their metacognition both individually and collectively. However, it is still not obvious how to effectively support students' (shared) metacognitive regulation during computer-supported collaborative learning (CSCL). [39], [40]. Additionally, even while it is likely that customized regulative help is especially beneficial for collaborative learners [41], [42], Interindividual variations in collaborative learners' shared metacognitive control behavior are little understood. While some studies concentrated on the variation in self-, co-, and shared regulation across groups [41], [43], Others have investigated how students' self-regulation skills influence their acceptance of shared regulation strategies in small groups [44], [45].

We investigated two important concepts in contemporary discussions about education and learning in the online environment: SRL and peer collaborative learning (PCL). We conducted a systematic literature review of all work addressing both concepts from 2010 to 2022 to enhance knowledge of these two ideas, including how they have influenced or might influence one another. We reviewed the evolving themes of online learning processes in the sections that followed. Following that, as part of online learning, we discuss collaboration, communication, and SRL in digital learning environments. Finally, we discuss how highly cited content reflects these competencies.

2. Results

Figure 1. Word could Chart

Figure 1.1 shows the word cloud of the frequently used words in data. Word frequency is shown visually in a "word cloud." The term appears larger in the image created depending on how frequently it appears in the text being evaluated. Word clouds are used more frequently as a quick tool to determine the main idea of narrative content [47]. The given word cloud shows the 50 most repeated words from the textual transcribed data. Words with big size mean that they have more repeated values as compared to words in a smaller size.

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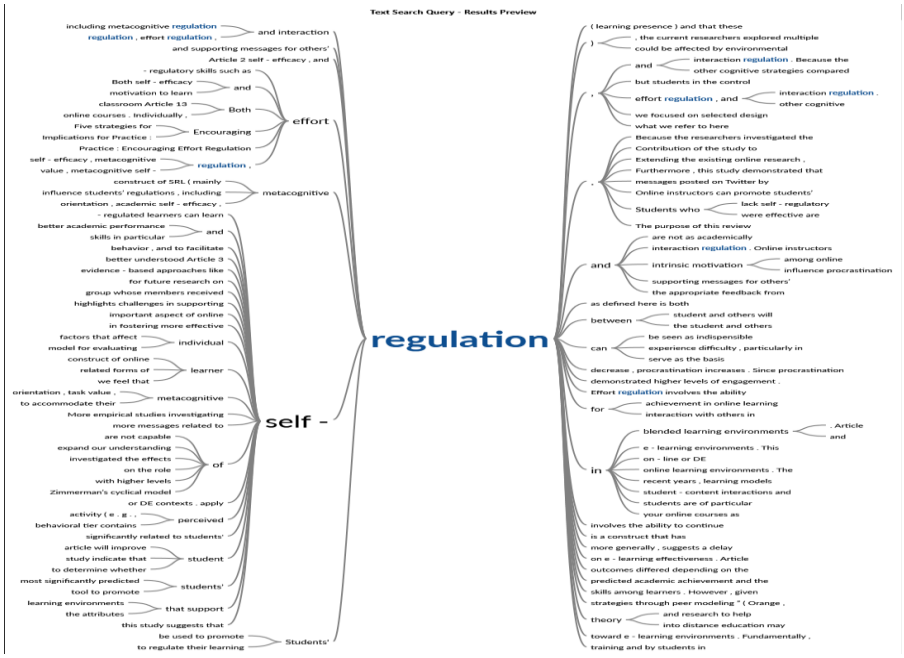

Figure 2. Word Tree of Self-regulation

Figure 1.2 shows the word tree of „self-regulation" that was generated from qualitative data acquired from impact factor journal articles. The word tree demonstrates a diverse pattern of analyses. It shows words or phrases used before and after the searched word. This helps in knowing the context in which it was used [48].

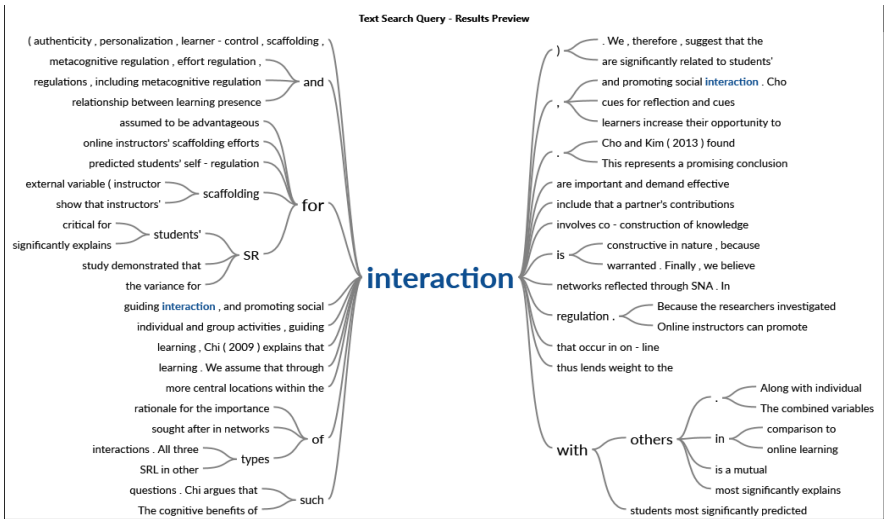

Figure 3. Word Tree of Interaction

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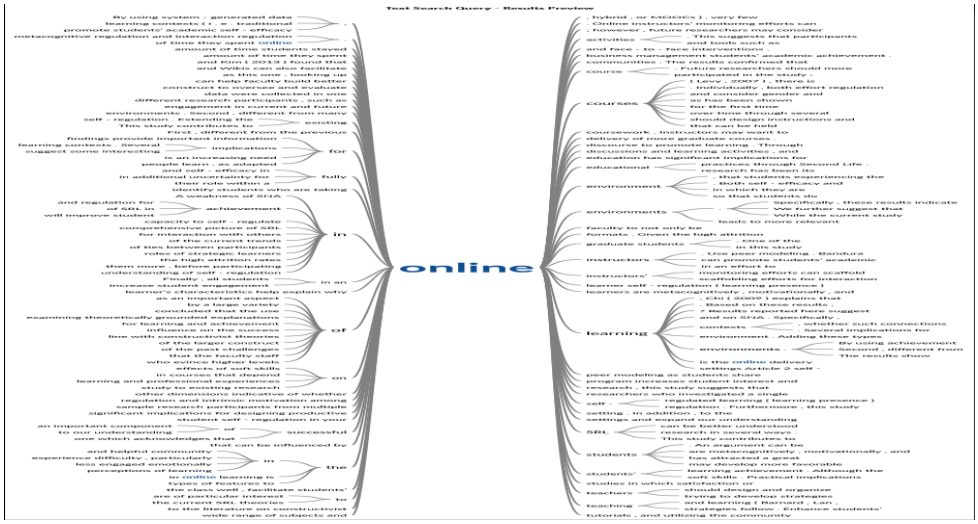

Figure 4. Word Tree of online learning

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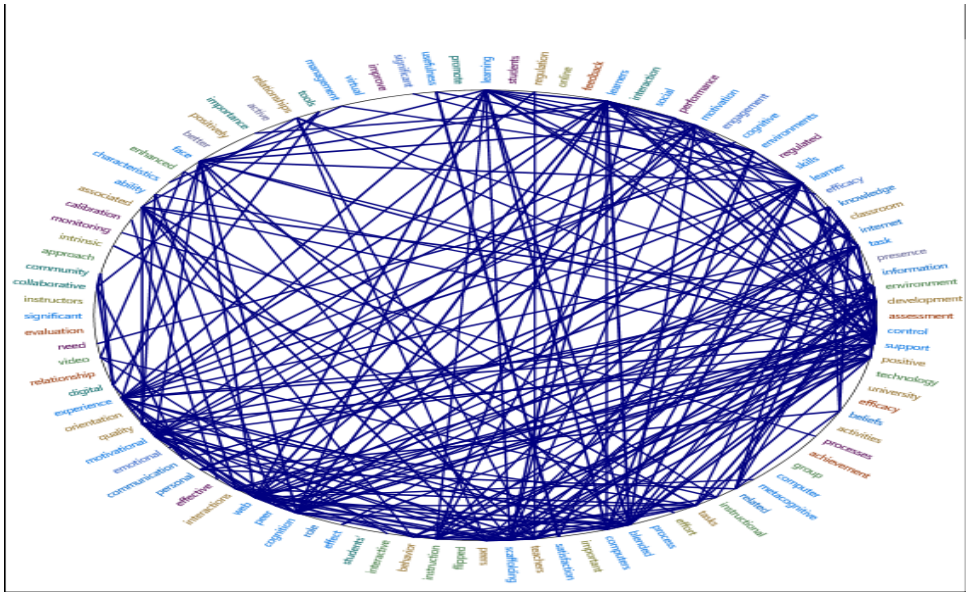

Figure 5. Cluster analysis of relationships of patterns

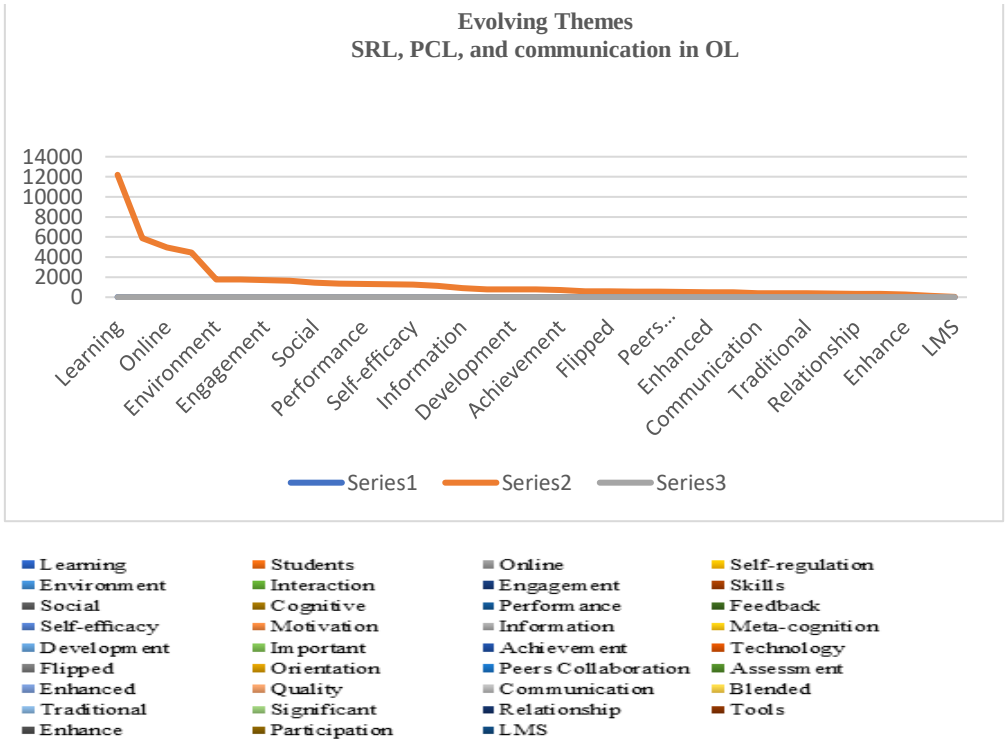

Figure 6. Bar Chart of Emerging patterns

3. Discussion

The SRL is a crucial component of learners that helps students achieve their personal objectives related to their learning objectives [49], however, this multidimensional idea cannot be understood in a plain or basic manner [50]. Self-regulation in learning has traditionally been approached from cognitive-behavioral [51] and cognitive-development perspectives [52]. Social and motivational aspects were studied by social cognitive researchers [53]. Metacognition was used as a lens through which to view self-regulation [54], [55]. Modern self-regulation theory includes cognitive, motivational, social, and behavioral elements while considering cultural, organizational, and contextual influences

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[56]. According to Zimmerman, self-regulation refers to how actively students participate in their own learning from a metacognitive, motivational, and behavioral perspective [57], [58]. In SRL students form goals that match their own needs and preferences (self-determination) and flexibly. One of the areas of self-regulation that best aligns with educational goals is self-directed learning. It refers to learning that is guided by metacognition, strategic action, and learning motivation in general [59]. Students learning behavior includes a variety of cognitive, metacognitive, and self-regulating learning and resource management techniques [60], [61]. SRL is multipurpose and adjustable, and learners often create their own toolkit of techniques [62]. According to Pintrich, pupils actively develop their meanings, objectives, and strategies based on knowledge both within and outside of their heads [63], [64]. Research reveals personal, environmental and behavioral determinants of SRL [65], [66]. The triadic paradigm links behavior to both internal and external causes. The usage of strategies is demonstrated as follows: from Person to Behavior, then to Environment. A person receives feedback from their environment and behavior. Additionally, it integrates covert, behavioral, and environmental self-regulation [67]. Therefore, the level of self-influence over the current learning environment and behavior will be referred to as self-regulation [68]. It entails self-generated ideas, emotions, and deeds to accomplish one's learning objectives. The model was then updated to include motivators, most notably self-efficacy. An example of a self-regulating dynamic loop model is provided by Zimmerman and Moylan. It consists of an executive phase that involves self-control and self-observation, a self-reflective phase that involves self-judgment and self-reaction, and a vision phase that involves task analysis and self-motivating beliefs. Self-efficacy, result expectations, task interest/value, and purpose are among the beliefs related to self-motivation. Most experts agree that the most significant component influencing autonomous learning is self-efficacy. The term "self-efficacy" was first used by psychologist Albert Bandura, who defined it as a person's confidence in their capacity to carry out specific tasks. Self-regulated learning processes are directly associated to self-efficacy, according to empirical studies [69], Self-efficacy and self-regulated learning techniques both contribute to the prediction of student achievement. A four-stage model of SRL was created by Pintrich. The following processes are involved: anticipating, planning, and activating; monitoring; viewing; and responding and reflecting. Cognition, motivation/influence, behavior, and context are each of them different regulatory domains. The two components of this process are the student's skill mastery and their switch ability, according to Boekaerts' model of SRL. The model attaches pupils' insights of their surroundings to various self-regulation strategies. Most modern researchers regard SRL as one of several factors that influence academic performance rather than as an autonomous multicomponent phenomenon. E-learning necessitates a unique learning environment. When teachers and peers are not present, the impact of social interactions is diminished. Existing social influence is spread via technological means. At the same time, students are in their familiar home environment, and immersion in the electronic education environment necessitates student participation. This is referred to as "learned presence" by Shea and Bidjerano. [70]. As a result, SRL is becoming more important. As a result, it's important to reconsider current SRL approaches and incorporate them into e-learning. In addition to adapting to changing contexts, new forms of education must also include elements that are less crucial for self-regulation in more established educational models. Although comparable tendencies have been seen at all educational levels, higher education has been the subject of the greatest study. In the context of SRL in an online environment, a systematic review suggested issues to investigate. These include metacognition, effort regulation, time management, peer learning, articulation, rehearsal, organization, critical thinking, and help-seeking [71]. However, the impact and opportunities of the digital learning are undervalued. OL intersects and create a communal e-learning space characterized by e-learning engagement. The level of involvement in online learning depends on two factors: the learning and internet environment, and the physical environment. Working in the higher education requires students to have certain capabilities and skills. Not only computer equipment, internet connection, and other necessary equipment, but even ergonomic factors

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such as furniture, lighting, sound, temperature, and color spectrum can cause problems with e-learning.

4. Materials and Methods

To find and collect empirical papers pertinent to addressing the study issues, we carried out a thorough literature review. In order to account for some retrieval sources, we modified the following search string: ("Online learn*" OR "e-learning*" OR "digital learn*" OR "blended learn" OR "hybrid instruction*" OR "online teaching" OR "hybrid course" OR "flipped classroom*" OR "flipped learn*" AND ("self-regulat*" OR "self-regulated*" OR SRL OR "peer collaboration*" OR "peer interaction" AND college* OR higher education* OR "tertiary education.

We looked for information in the following electronic databases: Crossref, Open Alex, Google Scholar, Scopus, PubMed, and Semantic Scholar in order to achieve the goals. The search was restricted to peer-reviewed, high-impact JCR English-language research published between 2010 and December 2022. With the use of cutting-edge algorithms from Herzing publish or perish, the research with the highest impact factors were found. This piece of software searches for and evaluates scholarly citations. It obtains the raw citation data from a variety of data sources, analyses it, and then offers a variety of citation metrics, such as the number of publications, the total number of citations, and the h-index [46].

Table 1.1 Selection Process and Criteria

Data Source	Crossref	Open Alex	Google Scholar	Scopus	PubMed	Semantic Scholar
Search Date	2022-12-11	2022-12-11	2022-12-11	2022-12-11	2022-12-11	2022-12-11
Papers	1000	8	998	1	84	1000
Citations	12429	320	65873	39	0	30365
Citations/year	1035.75	29.09	5489.42	6.50	0	660.1
Cite/paper	12.4	40.00	66.01	39.00	0.00	30.3
Authors/paper	$\bar{x}$=1.85	$\bar{x}$=2.63	$\bar{x}$=2.63	$\bar{x}$=1.00	$\bar{x}$=3.81	$\bar{x}$=2.75
High Index & citation %	52,64.8%	7, 99.1%	130,65.0%	1, 100.0%	0,0%	82, 52.3%
Annual-H Index Pop	3.17	0.55	6.75	0.17	0.00	1.39

The search resulted in 272 records with a high factor in impact size in the journal citation report JCR. Duplicates (n=192) were identified and removed.

5. Conclusions

The 48 pieces of research that were examined in this study produced various patterns that were found in articles about SRL, PCL, and student online communication. The research examined and reflected sufficient connections to make firm judgments about correlations of concepts. Further studies are therefore required to enhance the patterns and connections that we found in this analysis. The review identified prominent themes that surfaced in the high impact factor academic publication e.g., digital learning environment, interaction, engagement, feedback, self-efficacy, motivation, meta-cognition, achievement, technology, blended learning, and orientation of ICT, etc.).

- We also found that students can regulate each other when they work together, but this can be influenced by factors such as the student prior knowledge. We find that adaptive scaffolding in the form of a tutor appears to support many domains of a student's SRL as they learn online, and trains students to use certain processes and strategies before embarking on a task. Consistent with these trends, our study also identifies some challenges still faced by researchers working in this field of study. First, most studies fail to measure all diversity in SRLs. SRL research encompasses many aspects of learning that

have traditionally been explored in isolation, and this trend appears to be continuing. By definition, SRL is a cyclic, recursive, and active process that involves motivation, behavior, and context, making it difficult to capture in its entirety.

- Future research should focus on the quality of the employed SRL procedure because it has not received enough attention. To further our understanding, it is crucial to evaluate how well the SRL method is being used.
- Some studies did not relate the use of the SRL method to academic results. Despite the fact that all SRL models assume a connection between learning outcomes and SRL processes and that SRL theories were developed to explain variations in learning outcomes, this is the case. In our opinion, investigations examining SRL should take learning outcomes into account. If, despite non-significant learning differences, SRL processes are shown to differ between groups, this should be looked into and explained.

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