The Role of Self-Regulated Learning in Online Peer Learning: A Systematic Literature Review

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Abstract
This systematic review delves into the role of self-regulated learning (SRL) in online peer learning. Online peer learning has garnered significant attention as an effective educational approach, with SRL being a crucial factor in its success. The review thoroughly examines existing literature to identify themes, research methods, and findings related to integrating SRL and online peer learning. Employing a qualitative approach, relevant studies were reviewed, focusing on the relationship between SRL and online peer learning. The findings underscore the importance of SRL in fostering metacognitive awareness, self-control, goal-setting, and collaborative skills within online peer learning environments.
Despite the valuable insights gained from the reviewed studies, the current literature exhibits limitations, such as the limited number of longitudinal studies investigating the long-term effects of SRL interventions in online peer learning environments. Additionally, there is a dearth of research exploring the potential impact of cultural differences on SRL practices within these contexts. Furthermore, most existing literature focuses on specific academic disciplines or age groups, leaving gaps in our understanding of SRL's universality in diverse educational settings. Addressing these limitations will be vital in refining our understanding of SRL in online peer learning. The review concludes with implications for future research and practices to enhance SRL and optimize online peer learning experiences.
Keywords:e-Learning, ICT in Education, virtual learning, digital learning, medical education

Introduction

In recent years, online peer learning has emerged as a powerful educational strategy, harnessing the potential of digital platforms to foster active engagement, collaboration, and deep learning among students. Central to the effectiveness of this approach is the concept of self-regulated learning (SRL), a multifaceted construct encompassing learners' ability to monitor, control, and regulate their cognitive, motivational, and behavioral processes [1]. SRL equips students with diverse skills and strategies, including goal setting, time management, task strategies, seeking help, and creating an organized learning environment, all of which contribute to their intrinsic desire for excellence in the pursuit of knowledge.

At the core of SRL lies the capacity of students to generate planned and adaptable thoughts, feelings, and actions to achieve their learning objectives [2-4]. Meta-cognitive strategies, such as planning, monitoring, and regulation, along with effort management and cognitive strategies, form critical self-regulated learning components [5]. As educators seek to optimize online peer learning experiences, understanding the interplay between SRL and peer learning becomes essential, as it promises to enhance students' metacognitive awareness, self-control, goal-setting, and collaborative skills.

Online learning environments, emphasizing learner autonomy and subjectivity, provide an ideal setting for fostering SRL. In online peer learning, peer interactions facilitate the sharing of perspectives, constructive feedback, and collaborative problem-solving, enriching metacognitive processes and promoting self-regulatory skills development. The success of peer learning hinges on several factors, including communication quality, peer interaction, appropriate learning strategies, and students' self-control and motivation [6-7]. Research has indicated that higher levels of self-control and motivation lead to more significant benefits from peer learning experiences [6].

Emphasizing self-regulated learning in education has profound implications for academic success and lifelong learning. Empowering students to take ownership of their learning, set goals, monitor progress, use effective strategies, and adapt as needed fosters a sense of agency and empowerment. Therefore, addressing and improving students' SRL abilities in the online learning context becomes paramount.

Throughout peer learning, students engage in cyclical interactions that foster self-regulatory behaviors in all phases of SRL [8]. Frequent bidirectional feedback and peer assistance contribute to developing SRL skills as students internalize task strategies and enhance their SRL proficiency [9-10]. The act of seeking and providing help among peers further promotes the acquisition of self-regulated learning skills, and the prevalence of peer-to-peer interactions offers ample opportunities for self-regulation practice, including self-reflection. Shared accountability encourages the application of active learning strategies, such as seeking help and understanding others' perspectives [10].

Moreover, the impact of self-control extends beyond individual learning outcomes; it also influences students' social development within the peer learning environment. Students with high levels of self-control are more likely to engage in prosocial behaviors, such as helping and sharing, while reducing harmful behaviors like aggression and conflict[11]. This creates a supportive and inclusive atmosphere for peer learning, where students feel safe expressing their thoughts and ideas without fear of judgment or criticism[12].

This study's primary purpose is to comprehensively examine the existing literature on the role of self-regulated learning in online peer learning. Specifically, our objectives are to explore the following aspects:

- Themes related to the integration of self-regulated learning in online peer learning experiences.
- Research methods employed to study the use of self-regulated learning in online or blended educational settings.
- The influence of peer learning on students' self-regulated learning strategies in digital learning environment.

By undertaking this systematic literature review, we aim to shed light on the crucial role of self-regulated learning in online peer learning, elucidating the themes, research methods, and findings in this domain. The significance of this study lies in its potential to enhance online peer learning practices. By providing evidence-based insights, this paper can empower educators, researchers, and policymakers to foster a culture of self-regulated learning, enriching online learning experiences and promoting students' academic success in the ever-evolving digital age.

Methodology

This study employs a qualitative approach and a systematic literature review to investigate the role of self-regulated learning in the context of online peer learning among university students. The methodology employed in this study consists of six main steps: defining the scope of the review, identifying relevant literature, screening and selecting studies, extracting data, synthesizing the findings, and discussing the implications.

The data for this systematic literature review was obtained from published studies aligned with the research objectives. Electronic databases such as PubMed, Web of Science, Medline, CINAHL, and Google Scholar were thoroughly searched using specific keywords consistent with the medical subject headings (MeSH). The literature retrieved was then screened for eligibility. The key search terms included self-regulated learning, SRL, online peer learning, ICT, virtual peer learning, and digital peer learning. We precisely defined our topic of interest and the criteria for inclusion. Each concept was searched separately, utilizing subject headings that align with the MeSHs. To ensure rigorous reporting, this systematic review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework developed by Moher et al. [13], as depicted in Figure 1.

Eligibility criteria

Following the PRISMA Flow diagram (Fig. 1), our systematic literature review commenced with a comprehensive search across various databases, yielding 48 papers in the Identification Stage. To

ensure data accuracy, reference software (Endnote) was employed to identify and remove duplicates during the screening stage. Subsequently, we decided to exclude articles published more than ten years ago, as the field of online learning was still in its nascent stages.

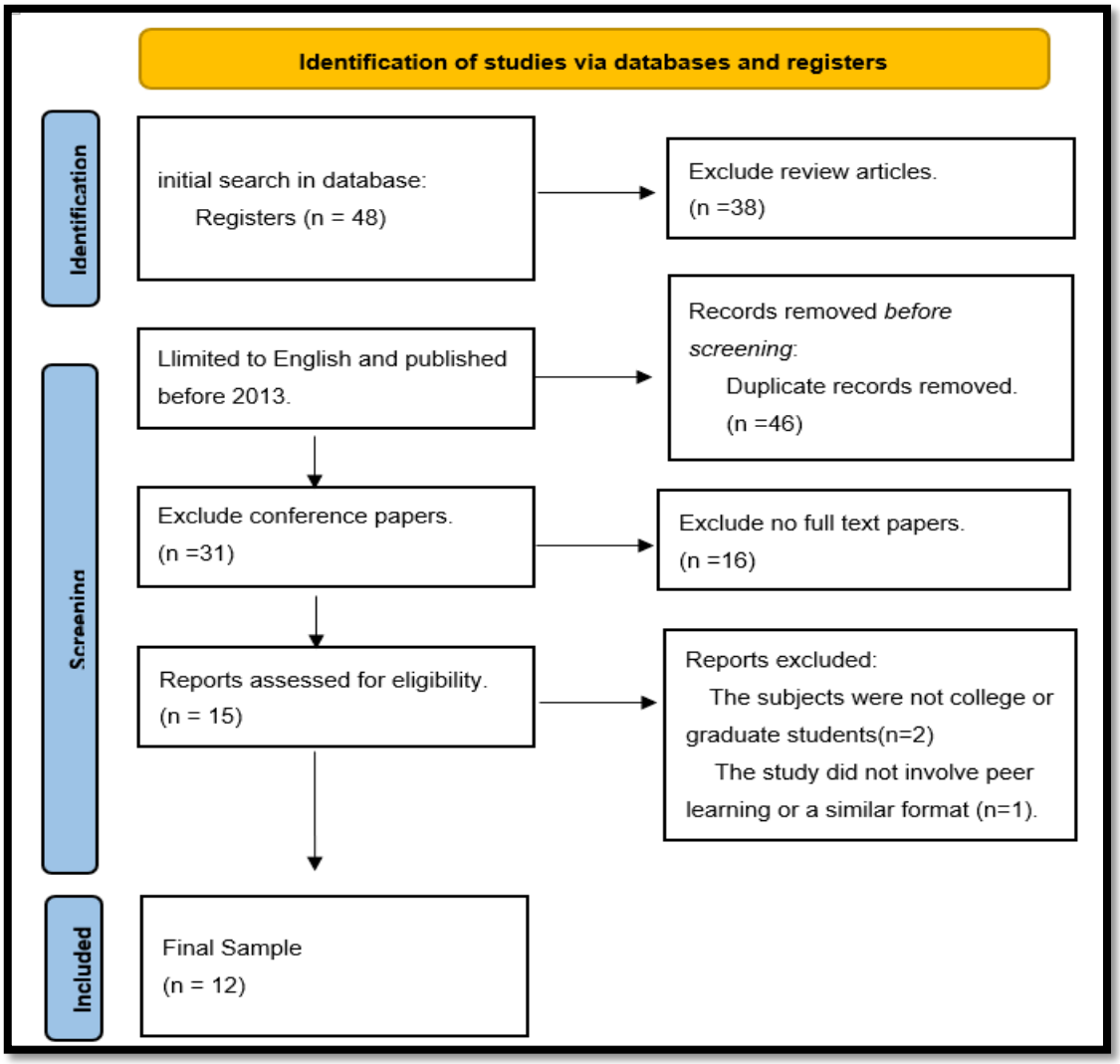

Figure 1. The PRISMA Flowchart of the Study

Eligibility for inclusion in the review was determined based on a thorough analysis of the publication titles, considering both the inclusion and exclusion criteria. We carefully examined the full-text articles and abstracts to ensure they met the predefined criteria. Studies in randomized control trials, nonrandomized control, longitudinal, and descriptive studies were considered eligible for inclusion in the review. Conversely, reviews, case studies, and conference articles were excluded from our analysis.

With these rigorous eligibility criteria, we aimed to ensure the selection of relevant and high-quality studies for our systematic literature review on the role of self-regulated learning in online peer learning. The transparent and robust approach to screening and selecting studies will enhance the reliability and validity of our review's findings and conclusions.

Data analysis

The data analysis for this study was conducted using content analysis. The dataset consisted of twelve selected papers for the systematic review. The materials extracted from these papers included the paper's title, the study's purpose, the self-regulated learning (SRL) strategies examined, non-academic outcomes, the methodology employed, and the study findings. The chosen papers were classified

based on their respective countries of origin, research methodologies, and non-academic outcomes to facilitate a comprehensive analysis. The synthesized information from the final papers was then summarized by country, offering a comparative overview of the findings and research trends across different nations (see Table 1). This approach enables a deeper understanding of the role of self-regulated learning in online peer learning. It provides valuable insights into potential regional variations and impacts.

Table 1. Source of Papers of Country

COUNTRY	FREQUENCY	PERCENTAGE (%)
UNITEDSTATES	3	25%
GERMANY	2	16.75%
TAIWAN	2	16.75%
AUSTRIA	1	8.3%
MALAYSIA	1	8.3%
SPAIN	1	8.3%
NETHERLANDS	1	8.3%
CLAYTON	1	8.3%
TOTAL	12	100%

The systematic review encompassed 12 papers from various countries, three from the United States and two from Germany and Taiwan. Additionally, one paper each came from Austria, Malaysia, Spain, Netherlands, and Clayton.

Among the selected papers, two from Taiwan were authored by the same author and were published in 2016 and 2018, respectively. Notably, two studies were conducted during the COVID-19 pandemic [14,15], focusing on the challenges and opportunities for self-regulated learning in the online learning environment.

Several papers explored fostering self-regulated learning in online environments [16,17]. In contrast, others delved into examining SRL strategies in blended learning and flipped classrooms, resulting in three papers [18,19,20]. Additionally, three studies explored the impact of group collaboration and team-based learning on self-regulated learning [21,22,23], offering insights into the benefits of collaborative learning experiences.

Furthermore, technology-enabled self-regulated learning and its effects were explored in three papers [24,25], shedding light on the role of technology in enhancing self-regulatory skills and peer learning interactions.

Two articles in this set of papers focused on developing self-regulated learning strategies [16,18,19,22]. In contrast, four papers investigated how self-regulated learning could enhance academic performance [16,18,19,26]. Additionally, four studies examined the relationship between mobile learning (m-learning), self-regulated learning, and other factors such as gender, mental health, learner modalities, and dependence [14,17,25,26], uncovering valuable insights into the interplay between these factors and SRL.

Moreover, three papers explored self-regulated learning models, including Mirroring Scaffolds and external scaffolds [19,22,24]. These models offered novel approaches to support and enhance students' self-regulatory processes in diverse learning contexts.

The selected papers presented diverse perspectives on the role of self-regulated learning in online peer learning, encompassing various research methodologies and shedding light on crucial aspects such as academic performance, collaborative learning, and the influence of technology.

Results And Discussion

Themes in the Literature

The review identified several themes related to the role of SRL in online peer learning. These included the impact of SRL on metacognitive processes, the influence of SRL on self-control and self-monitoring,

the role of SRL in goal-setting and planning, and the development of collaborative skils within online peer learning environments.

Based on the draft, the identified themes related to the role of self-regulated learning (SRL) in online peer lerning are as follows:

Impact on Metacognitive Processes: The review highlights how SRL influences and enhances metacognitive processes among learners. Metacognition involves awareness and control of cognitive activities, such as planning, monitoring, and evaluating learning progress. SRL fosters students' ability to reflect on their learning strategies and adjust to optimize their learning experiences.

Influence on Self-Control and Self-Monitoring: Self-control and self-monitoring are crucial aspects of SRL. Learners with solid self-regulatory skills exhibit greater self-control in managing distractions and maintaining focus during online peer learning activities. Moreover, they actively monitor their learning progress and adjust their strategies accordingly.

Role in Goal-Setting and Planning: SRL is pivotal in empowering learners to set meaningful goals and develop effective plans. By setting specific, measurable, attainable, relevant, and time-bound (SMART) goals, learners can enhance their engagement and motivation in the online peer learning environment.

Development of Collaborative Skills: Online peer learning environments provide unique collaborative learning experiences. SRL helps learners develop collaborative skills, such as effective communication, active listening, and providing constructive feedback to peers[27]. These collaborative skills promote meaningful interactions and group dynamics within the online learning community.

These identified themes collectively provide valuable insights into the multifaceted nature of self-regulated learning in the context of online peer learning. It also shows that by understanding these themes, educators and researchers can design interventions and strategies that foster SRL competencies, enhancing learning outcomes and student engagement in online peer learning environments.

Research Methods Used

The systematic review encompassed studies that employed various research methods to explore the relationship between SRL and online peer learning outcomes:

Quantitative Studies: Seven studies (58.4%) adopted a quantitative approach, utilizing surveys, questionnaires, and statistical analyses to quantitatively measure and examine the impact of SRL on online peer learning outcomes. These studies focused on gathering numerical data and establishing statistical correlations.

Qualitative Studies: Four studies (33.3%) followed a qualitative methodology, utilizing interviews, observations, and content analysis to explore learners' experiences and perceptions regarding SRL in online peer learning. These studies aimed to gain in-depth insights into learners' behaviors, attitudes, and motivations.

Mixed-Methods Studies: One study (8.3%) employed a mixed-methods approach, combining quantitative and qualitative data collection and analysis techniques. This methodological choice allowed researchers to triangulate findings from different sources and provide a comprehensive understanding of the topic.

The study designs of the reviewed literature include the following:

Cross-Sectional and Longitudinal Studies: Eight studies (66.7%) adopted cross-sectional and longitudinal designs. These studies gathered data at a specific time (cross-sectional) and over an extended period (longitudinal) to assess changes and developments in SRL and online peer learning outcomes.

Cross-Sectional Studies: Three studies (25%) followed a cross-sectional design, collecting data at a specific moment to investigate the relationship between SRL and online peer learning.

Mixed-Methods: One study (8.3%) incorporated a mixed-methods design, utilizing cross-sectional and longitudinal data collection methods to comprehensively analyze SRL in online peer learning.

The diverse research methods used in the selected studies demonstrate the multidimensional nature of

the investigation into SRL in online peer learning. The combination of quantitative, qualitative, and mixed-methods approaches enriches understanding of how SRL impacts various aspects of online peer learning experiences.

The influence of peer learning on students' self-regulated learning strategies in digital environments

The impact of peer learning on students' self-regulation strategies is categorized based on the identified theme. These impacts include:

1. The Impact of SRL on Metacognitive Processes

The systematic review underscores the significant impact of self-regulated learning (SRL) on fostering learners' metacognitive awareness within online peer learning [2]. According to Pintrich (1995), SRL involves learners' ability to self-generate thoughts, emotions, and actions that are planned and cyclically adapted to achieve learning goals. In online peer learning, SRL empowers learners to understand their learning progress better and make timely adjustments and reflections [3].

The finding that self-regulated learning positively influences metacognitive processes in online peer learning indicates that learners with strong SRL skills exhibit heightened awareness and control over their cognitive activities. This heightened metacognitive awareness allows learners to plan, monitor, and evaluate their learning progress effectively. Learners who actively engage in self-regulation are more likely to adopt adaptive learning strategies, set realistic goals, and identify areas for improvement. Such metacognitive processes contribute to deeper understanding, retention, and application of knowledge, enhancing overall learning outcomes. Educators and online course designers should focus on fostering metacognitive processes among learners by incorporating opportunities for self-reflection, self-assessment, and goal-setting within online peer learning environments. Implementing metacognitive strategies, such as thinking-aloud protocols and reflective journals, can empower learners to develop solid metacognitive awareness and enhance their learning experiences.

2. The Influence of SRL on Self-Control and Self-Monitoring:

Research findings indicate that SRL also plays a crucial role in positively influencing learners' self-control and self-monitoring abilities in the online peer learning environment [1][17]. Zimmerman (1998) emphasizes that SRL helps learners establish self-fulfilling cycles of academic regulation, leading to improved self-monitoring and learning outcomes. With its collaborative and supportive nature, online peer learning fosters the development of learners' self-control and self-monitoring skills, contributing to their overall academic success [24].

The finding that self-regulated learning positively impacts learners' self-control and self-monitoring abilities suggests that learners who effectively regulate their learning behaviors exhibit greater self-discipline, self-management, and focus during online peer learning activities. Learners with enhanced self-control are more likely to resist distractions, manage their time effectively, and persist in challenging tasks, leading to improved academic performance and greater engagement in the learning process. Additionally, self-monitoring enables learners to assess their progress, identify areas for improvement, and adapt their learning strategies accordingly[28]. Emphasizing the development of self-control and self-monitoring skills in online peer learning is vital. Educators can integrate self-regulation training, time management strategies, and goal-setting exercises to empower learners to become proactive and responsible in their learning journey.

3. The Role of Self-Regulated Learning in Goal-Setting and Planning

The systematic review reveals that SRL significantly contributes to learners' goal-setting and planning abilities in online peer learning [15][19]. Notably, Lim's (2020) research demonstrates that online peer learning provides learners with a platform to set meaningful learning goals and develop effective learning plans, resulting in enhanced learning outcomes. Additionally, Bellhäuser et al.'s (2022) study highlights the positive impact of self-control learning training within online peer learning, facilitating the formation of positive learning behaviors that support goal-setting and planning [16].

The finding that self-regulated learning significantly contributes to learners' goal-setting and planning abilities highlights the pivotal role of SRL in empowering learners to set meaningful learning objectives and create effective action plans. Learners who engage in effective goal-setting are more likely to be motivated, focused, and proactive in their online peer learning activities. Moreover, systematic planning enables learners to break down complex tasks into manageable steps, leading to a sense of accomplishment and increased self-efficacy. Facilitating the development of goal-setting and planning skills should be a priority in online peer learning environments. Educators can guide learners by setting specific, attainable, and time-bound goals, encouraging them to create action plans that align with their learning preferences and strengths.

4. Development of Collaborative Skills Within Online Peer Learning Environments

The review emphasizes that online peer learning environments are conducive to developing learners' collaborative skills, with self-regulated learning playing a vital role in this process [21][23]. Lin's (2016) research provides evidence that the collaboration and mutual assistance inherent in online peer learning foster the development of learners' collaborative skills. Moreover, the collaborative nature of peer learning offers valuable opportunities for learners to practice self-regulation during collaborative activities, enhancing their overall self-regulatory abilities [22].

The review's emphasis on the role of self-regulated learning in fostering collaborative skills within online peer learning environments indicates that SRL promotes effective communication, active listening, and constructive feedback among learners. Learners with solid self-regulatory abilities are more likely to engage in collaborative activities with a sense of responsibility and commitment. They can actively contribute to group discussions, share ideas, and support their peers, leading to a more enriching and supportive learning community. Encouraging collaborative learning experiences and promoting self-regulation within group interactions is essential for cultivating a positive online peer learning environment. Creating structured collaborative activities, encouraging peer feedback, and offering opportunities for joint problem-solving can nurture learners' collaborative skills and enhance the overall learning experience.

The systematic review presents compelling evidence of the multifaceted impact of self-regulated learning on various aspects of online peer learning. The themes identified shed light on the critical role of SRL in fostering metacognitive awareness, self-control, goal-setting, and collaborative skills, contributing to learners' success in the online learning environment.

The identified themes highlight the indispensable role of self-regulated learning in online peer learning and underscore the importance of fostering metacognitive awareness, self-control, goal-setting, and collaborative skills among learners. Incorporating strategies that support these themes can lead to improved learning outcomes, increased learner engagement, and the creation of a dynamic and supportive online learning community. Educators and policymakers should consider these findings when designing online peer learning experiences and developing interventions to enhance self-regulation in the digital learning landscape.

Conclusion

Self-controlled and online peer learning represent distinct learning styles, emphasizing individual initiative and collaborative support. However, this systematic review has unveiled a meaningful connection and interaction between these two approaches, revealing a mutually reinforcing relationship. By strategically adapting self-regulated learning (SRL) strategies to harness the benefits of peer learning during the educational journey, learners' self-controlled learning experiences can be significantly enhanced, contributing to the flourishing of online peer learning environments [29].

The synthesis of significant findings from 12 primary research studies published over a decade has unequivocally demonstrated the paramount importance of self-regulated learning in online peer learning. SRL plays a multifaceted role in enhancing learners' metacognitive processes, self-control,

goal-setting, and collaborative skills. This comprehensive integration of SRL in online peer learning environments holds great promise for fostering deep and meaningful learning experiences.

The implications of these findings extend far and wide for educators and researchers. Collaborative efforts between educators and researchers are essential to explore further and refine the integration of self-regulated learning and online peer learning, striving for optimal learning experiences and outcomes. By nurturing self-regulated learning practices, educators empower learners to become proactive, self-directed, and actively engaged participants in the online peer learning journey, fostering more profound understanding and knowledge construction.

Additionally, it is crucial to acknowledge and address potential limitations in the systematic review. Consideration of biases in the selected studies, the literature review's scope, and the findings' generalizability will further enhance the rigor and credibility of future research endeavors in this domain.

Educators can leverage the insights gained from this systematic review to design practical and innovative online peer learning experiences that capitalize on self-regulated learning strategies. Integrating technology-enhanced learning tools and pedagogical approaches can further optimize learners' self-regulatory skills in the dynamic online landscape.

Ultimately, the educational impact of incorporating self-regulated learning within online peer learning environments cannot be underestimated. This harmonious fusion of self-controlled learning and collaborative peer interactions nurtures the development of self-directed, lifelong learners who possess the essential skills, resilience, and adaptability to thrive in an ever-evolving digital world. Emphasizing the development of metacognitive awareness, self-control, goal-setting, and collaborative skills, this holistic approach is the cornerstone of a vibrant and thriving learning ecosystem. As educators and researchers jointly advance this integrated approach, they pave the way for a transformative future of online education that empowers learners to reach their full potential and contribute meaningfully to the global knowledge community[30].

Recommendations

The findings of this systematic review hold significant implications for both research and practice, presenting an opportunity for educators and researchers to foster more effective online peer learning experiences by integrating self-regulated learning (SRL) strategies. Building upon the results, findings, and conclusions, the following comprehensive set of recommendations is proposed:

Individualized Support: Educators should adopt a learner-centric approach by providing individualized support to students in developing their self-regulated learning skills. Tailoring instructional methods and interventions to meet the unique needs of each learner can enhance their self-regulation capabilities and overall learning outcomes.

Assessing SRL Progress: Implementing regular and robust assessments of learners' self-regulated learning progress in online peer learning is crucial. Valid and reliable assessment tools can offer valuable insights into learners' evolving SRL competencies, enabling educators to identify areas for improvement and tailor interventions accordingly.

Cultivating Metacognitive Reflection: Encouraging metacognitive reflection within online peer learning environments can foster learners' ability to assess and monitor their learning processes. Educators should incorporate opportunities for learners to engage in self-assessment, self-questioning, and self-evaluation to deepen their metacognitive awareness.

Professional Development for Educators: Educators need specialized training and professional development to effectively integrate SRL into online peer learning. Institutes and organizations should offer comprehensive workshops and resources to empower educators with the necessary skills to scaffold and support learners in their self-regulatory journey effectively.

Leveraging Learning Analytics: Integrating learning analytics in online peer learning environments can

provide real-time data on learners' engagement, progress, and behavior. By leveraging learning analytics insights, educators can make data-driven decisions, identify learning patterns, and personalize learning experiences to optimize student success.

Conducting Longitudinal Studies: To gain a deeper understanding of the sustained impact of self-regulated learning on online peer learning outcomes, researchers should conduct longitudinal studies that follow learners over extended periods. This longitudinal approach can reveal developmental trajectories and uncover factors influencing long-term SRL practices.

Investigating Cross-Cultural Perspectives: Further research should explore the role of cultural factors in self-regulated learning and online peer learning. Comparative, cross-cultural studies can elucidate how cultural nuances influence the adoption and effectiveness of SRL strategies across diverse learner populations.

Promoting Inclusive Practices: Inclusive design principles should be embraced when developing online peer learning environments. Creating accessible and inclusive learning spaces that cater to diverse learning styles, preferences, and abilities fosters an equitable and supportive learning experience for all learners.

It is hoped that by incorporating these comprehensive recommendations, educators and researchers can collaboratively advance the integration of self-regulated learning in online peer learning, leading to enhanced learning outcomes, increased student engagement, and the cultivation of self-directed and lifelong learners prepared to succeed in an ever-evolving digital landscape.

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