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New challenges for higher education: self-regulated learning in blended learning contexts

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Introduction: The study on self-regulated learning in blended learning (BL) environments highlights its crucial relevance for both the academic development of students and the evolution of contemporary educational methods. This research focused on conceptualizing self-regulated learning in university contexts with a BL modality, using direct student perceptions.

Methods: An inductive qualitative approach with a phenomenological design was employed. Responses from 312 undergraduate students who had completed their first or second year were analyzed; 65 participated in 10 focus groups (two per area of knowledge according to OECD classification), and 247 participated through a survey. Descriptive analysis was used to obtain a range of content and meanings associated with students' perceptions of SRL-BL.

Results: The study conceptualized SRL-BL as a process where students structure, monitor, and evaluate their learning using self-reflection and digital technologies, with particular emphasis on planning. Significant differences were identified between SRL-BL and traditional SRL; in face-to-face education, teacher supervision is greater, while in SRL-BL, students take on more responsibility and autonomy, developing self-management skills. Although SRL-BL fosters autonomy and responsibility, students face obstacles such as distractions from social media and leisure technologies, which affect their concentration and study planning.

Discussion: It is essential to address the new challenges students face to maintain a high level of SRL in Blended Learning environments (SRL-BL) and the strategies they use to overcome them. The need to update the concept of self-regulated learning (SRL) in the current educational context, influenced by technological advances, is concluded.

KEYWORDS

self-regulated learning, online education, blended learning, university students, quality in education, education

1 Introduction

Self-regulated learning (SRL) is a construct with strong empirical support regarding its importance for success in higher education (Bernardo et al., 2020). Self-regulated students are more successful in learning because they plan, set goals, organize, and self-evaluate throughout their learning process (Yahya et al., 2021).

Research in higher education associates self-regulated learning with successful academic pathways by promoting better performance and higher retention rates (Barrera Hernández et al., 2020; Díaz et al., 2019a; Merchan and Hernández, 2018; Panadero et al., 2016; Sáez et al., 2018), greater engagement in academic activities (Barrera Hernández et al., 2020), and better adjustment to university life (Hernández Barrios and Camargo Uribe, 2017). Interventions aimed at fostering self-regulation have proven effective in improving performance and preventing dropout (Díaz-Mujica et al., 2017; Dörrenbächer and Perels, 2016; Järvelä et al., 2019; Sáez et al., 2018; Yan, 2020).

SRL is understood as a cyclical and interdependent process that integrates the control, planning, and adaptation of thoughts, behaviors, and feelings aimed at achieving a learning goal (León-Ron et al., 2020). According to Zimmerman's (2000) Social Cognitive Theory, self-regulation is achieved through three cyclical phases during learning: planning, execution, and evaluation. In the planning phase, students set goals they aim to achieve; in the execution phase, they deploy cognitive learning strategies (e.g., reading and note-taking) and metacognitive monitoring processes to complete tasks (e.g., time management); in the evaluation phase, students assess their progress and understanding of the material and evaluate the factors contributing to their performance. Based on these reflections, students may decide to modify their behaviors to achieve current tasks or begin new ones. These phases are interdependent and do not necessarily occur in a sequential order, nor do they happen only once during a task (Zhang et al., 2021).

Promoting this competence in university contexts is especially important. Higher education faces significant challenges, including the massification of enrollments, a new student profile, and high dropout rates in the early years of study (Díaz et al., 2019a; Ferreyra et al., 2017; Munizaga et al., 2018). Not all students have the tools to successfully face higher education; there are significant gaps in the knowledge level with which they enter university, their learning strategies and thinking skills, their behaviors in adjusting to university life, and their ability to autonomously control and manage their learning (Bernardo et al., 2020; Díaz et al., 2019b; Taranto and Buchanan, 2020).

Continuing studies during the pandemic relied on online education, a modality that demanded a more active and autonomous role from students (Besser et al., 2022; Kincade et al., 2020; Lobos et al., 2021). Research conducted in this scenario (Hodges et al., 2020; Viberga et al., 2018) indicates that online education exacerbates the previously mentioned gaps, as it requires students to have greater capabilities to self-regulate their learning compared to face-to-face education.

Post-pandemic higher education is expected to predominantly feature hybrid or Blended Learning (BL) models (Almazán Gómez, 2020; Lederman, 2020; Portillo, 2020). Research conducted with 8,265 Chilean university students during the confinement period (Lobos et al., 2021) comparing expectations versus experiences with Emergency Remote Education (ERE) indicated that the experience with ERE improved students' perceptions of the quality and benefits of online education, contrasting with their initial expectations at the beginning of the confinement period. In Israel, a study with 1,217 university students (Besser et al., 2022) found results consistent with those of the Chilean students, concluding that adaptability and facing challenges with ERE generate a positive perception among students toward online education, facilitating the establishment of a post-pandemic Blended Learning model.

Recent research indicates that online teaching and learning have become imperative (Kamali and Bagheri-Nesami, 2022), setting a precedent for a new reality in higher education (Gqibani, 2022).

There is a need to offer mixed teaching, as this style combines many advantages of both virtual and face-to-face formats while minimizing their disadvantages (Pollock, 2022). In line with this, Jamilah and Fahyuni (2022) suggest that online teaching should be modified and combined with face-to-face learning in mixed teaching methods, which can overcome the deficiencies of online and face-to-face learning alone. This vision is shared by teachers, students, and administrators, as concluded by the study by Guppy et al. (2022).

In the BL modality, the virtual component is carried out through virtual classrooms that provide a suitable environment for the development of resources and asynchronous learning activities. The use of virtual classrooms has steadily grown worldwide, not only due to the emergency created by the pandemic but also because of the impact of new digital technologies and the increasing demand for graduates with digital skills to address the ongoing digital evolution in our society (Afify et al., 2023).

The virtual classroom is identified as a space for educational innovation, characterized by its flexibility and the versatile integration of content through a variety of resources and learning activities (Martínez and Jiménez, 2020). As such, virtual classrooms represent one of the most important applications of educational technology and are a primary means in interactive online education systems (Afify et al., 2023). They emphasize student independence and motivation, aiming to strengthen autonomous learning, critical thinking, and collaborative work through interaction and the development of academic activities (Martínez and Jiménez, 2020).

Learning Management Systems (LMS) also serve as essential technological support for teaching and learning in universities worldwide (Ghazal et al., 2018). They provide teachers with platforms that allow for information dissemination and classroom management (Simon et al., 2024). LMSs host a variety of tools that can facilitate user communication, such as discussion forums, real-time chat modules, and email clients (Turnbull et al., 2023). All these changes position self-regulated learning as a necessary competency for every student facing higher education.

1.1 Self-regulated learning and online education

Online education depends on the student being in a different location from the teacher or the source of information (Ibrahim Qetesh et al., 2020; Quezada Cáceres and Salinas Tapia, 2021). This modern educational phenomenon has evolved with technological advancements (Eljak et al., 2023; Kaplan and Michael, 2016).

During the pandemic, this modality was referred to as Emergency Remote Education (ERE) because it did not meet all the requirements of online education but was considered a step toward it (Talidong, 2020). Post-pandemic, it is anticipated that there will be a process of curriculum flexibilization, not to migrate entirely to online teaching, but to integrate online teaching with traditional teaching and leverage its benefits (Almazán Gómez, 2020; Lederman, 2020; Pardo and Cobo, 2020). In this context, ERE helped increase awareness of the influence of self-regulated learning in higher online education (Ibrahim Qetesh et al., 2020; Quezada Cáceres and Salinas Tapia, 2021), highlighting areas of concern for post-pandemic BL education (Cobo-Rendón et al., 2022; Shesha, 2023).

The teaching modality that combines in-person components with online components through computer systems is known as BL, a

relatively new term in literature that began to be used and researched in the late 1990s (Hrastinski, 2009). BL can be described as a teaching method with bimodal delivery (in-person and online) that aims to holistically, intentionally, and effectively integrate technologies, strategies, and pedagogical activities, optimizing time by eliminating barriers of space, time, and resources (Freeman et al., 2014; Sia et al., 2023).

BL education promotes interaction, reflection, critical thinking, and facilitates spaces for collaborative work and an active attitude toward the learning process (Singh and Thurman, 2019). Implementing this educational model poses significant challenges for students who struggle to self-regulate their learning (Besser et al., 2022; Kincade et al., 2020; Lobos et al., 2021). For example, in the planning phase of self-regulation, students must consider various factors such as access to a computer at home, internet connection quality, and plan a workload by estimating the time required for asynchronous activities (Zhang et al., 2021). Aristovnik et al. (2020) noted that BL online education created a perception of a heavier workload among students due to time management and academic work organization difficulties.

In the execution phase, students face higher barriers to seeking help, maintaining concentration, and actively monitoring the time spent on each task (Adnan and Anwar, 2020). Leveling strategies like mastery paths encourage the use of various cognitive strategies for the same content and force students to monitor their performance when they do not reach the expected level (Goksoy, 2018). In the evaluation phase, students must make value judgments about their learning outcomes and study processes, considering new factors like the organization of materials in the virtual environment and their digital competence. Online evaluation systems often allow multiple attempts, which can encourage students to reflect on their performance and take corrective measures in their learning processes (Zhang et al., 2021).

In this new scenario, where virtual classrooms are an integral part of university education and the online component complements and enhances learning, it is necessary to update the concept of self-regulated learning (SRL) to meet the new demands of the Blended Learning context. This study's objectives are to:

- 1 Conceptualize the process of Self-Regulated Learning in the context of Blended Learning (BL), identifying its characteristics and specific strategies.
- 2 Compare and contrast the differences between the process of Self-Regulated Learning in Blended Learning (SRL-BL) and the traditional approach (SRL-T), highlighting the necessary adaptations for the contemporary educational context.
- 3 Identify the main benefits and obstacles students face in implementing Self-Regulated Learning in BL modalities, to propose effective strategies for overcoming them.

2 Method

2.1 Design

An inductive qualitative approach with a phenomenological design was employed. This design aims to identify and systematize the ways people understand, experience, conceptualize, and perceive aspects of reality (Marton, 1981). Hermeneutic text analysis was used to understand the meaning and significance of students' discourses on SRL BL (Martínez Miguélez, 2002). This approach combines

phenomenology, which focuses on describing lived experiences as they are experienced, with hermeneutics, which emphasizes the interpretation of the meanings of those experiences (Izcarra, 2014). This combination allows researchers to gain a rich and deep understanding of students' experiences by integrating both the detailed description of the experiences and the interpretation of their deeper meanings.

2.2 Participants

The sample consisted of 312 undergraduate students who had completed their first or second year of study. Sixty-five participated in 10 focus groups (two focus groups per knowledge area according to the OECD classification), and 247 participated in a survey. Of the participants, 56% (166) were women and 44% (131) were men, with an average age of 19.07 (SD 1.56). 48% (142) had completed their first year of study, and 52% (155) had completed their second. The students belonged to four Chilean universities that use the BL modality through their virtual classrooms. Table 1 describes the number of students according to their scientific area (OECD) and the type of participation in the study.

2.3 Instruments

2.3.1 Focus groups

The focus groups were conducted in the classrooms of the participating universities, lasting between 45 and 70 min. The focus group script included the following topics: (a) Conceptualization of SRL (Example: What do you understand by SRL in a blended learning educational context?) (b) Differences between SRL in face-to-face and BL contexts (Example: What could be the differences between a student who self-regulates their learning in face-to-face education versus one who learns in both face-to-face and virtual teaching environments?) (c) Planning strategies used for SRL in BL (Example: How do you plan to meet the academic commitments of the virtual classroom?) (d) Execution strategies for SRL in BL (Example: What do you do to monitor your level of learning during your study in the virtual classroom?) (e) Evaluation strategies for SRL in BL (Example: Once you have completed a study cycle, what do you do to evaluate your learning?) and (f) Benefits and obstacles for SRL in BL (Example: In a blended learning study modality, what would be the benefits of possessing good self-regulated learning skills; what obstacles could you face for self-regulation in a blended learning context?).

TABLE 1 Description of participants by scientific area and type of participation in the study.

OCDE area	Focus Groups	Surveys
Natural Sciences	16	36
Medical and Health Sciences	10	46
Humanities	12	23
Agricultural Sciences	9	0
Social Sciences	8	103
Engineering and Technology	10	39
Total	65	247

2.3.2 Survey on self-regulated learning in BL environments

Written discourses were obtained from a survey with three open-ended questions created specifically for the research. The questions addressed the following topics: (a) students' understanding of SRL in BL (How would you define SRL in BL?) (b) strategies they use for SRL in BL (What strategies would you use for SRL in BL?) and (c) differences they find between SRL in BL and traditional SRL (What differences could there be between SRL in a face-to-face educational context and SRL in BL?).

2.4 Procedure and ethical considerations

The survey was administered digitally via Google Forms and sent to the students of the participating universities through institutional email. Participants for the focus groups were obtained through non-probability sampling using the snowball technique. University professors with prior connections to the researchers were asked to invite 12 students from their courses to participate in the focus groups, ensuring that the courses covered the six OECD areas. Three of the seven focus groups were conducted in person, and four were conducted via videoconference using the Teams platform. Ethical guidelines and principles were followed, including the use of informed consent, secure storage of information in coded databases, and ensuring the confidentiality of the information.

2.5 Analysis plan

The analysis of the discourses was conducted in three main stages: (1) reviewing the information, (2) identifying units of analysis, and (3) categorizing. Using the constant comparison method, the information was coded and analyzed simultaneously. Coding continued until theoretical saturation of the generated categories was reached, meaning no new data provided additional information (Krause, 1995). Through descriptive analysis, a range of contents and meanings associated with students' perceptions of SRL-BL was obtained.

To accomplish this, an immersive reading process is carried out, where the transcriptions are read multiple times to familiarize yourself with the content and gain a general overview. Notes are taken on general impressions and recurring themes. Then, for the phenomenological description, the text is divided into smaller meaning units that capture specific aspects of the experiences associated with SRL in BL described by the students. Codes are assigned to these meaning units, labeling them in a way that reflects their essential content. For the hermeneutic analysis, a reflection on the underlying meanings of the meaning units is conducted, considering the BL university context and the individual perspectives of the participants. The meaning units are then grouped into broader themes that capture recurring and significant patterns in the discourses about SRL in BL. Finally, the interpretations are reviewed and refined by comparing them with the existing literature.

3 Results

The study aimed to conceptualize self-regulated learning in university education contexts with a BL modality from the students'

perspectives. Their discourses were analyzed, and the results were organized into the following areas: (a) how they define it, (b) what competencies they consider it requires, (c) what strategies would facilitate better levels of SRL BL, (d) differences between SRL BL and SRL traditional, and (e) situations that threaten the achievement of SRL BL.

3.1 Definition of SRL in BL education

Students define SRL-BL considering the same three stages of traditional SRL: planning, execution, and evaluation. "I understand it as a process of self-reflection and action where the student structures, monitors, and evaluates their learning," (E39) adding the use of technologies. However, when asked for a more detailed description of SRL-BL, their narratives focus on the planning stage and to a lesser extent on execution, with no content associated with the evaluation stage. "I understand it as a concept that encompasses everything that is an academic organization, which the student must develop independently, establishing schedules and finding the most suitable and efficient method for them using these virtual platforms" (E46). In less precise responses, students equate SRL-BL to autonomous learning. "It consists of having the necessary tools for proper learning without needing someone to regulate it," and "I understand it as my autonomy to better manage my studies" (E44).

The students' emphasis on planning and autonomy, coupled with the limited focus on execution and evaluation, suggests that they perceive SRL-BL primarily as a preparatory and organizational process. This may indicate a need for educational interventions that emphasize the iterative and cyclical nature of self-regulation, including reflection and self-assessment. The integration of technology in their definition's points to an evolving understanding of SRL-BL, where digital tools are not merely aids but integral components of the learning process. This evolution reflects broader shifts in educational practices, emphasizing the role of technology in facilitating self-regulated learning. The lack of attention to evaluation suggests potential areas for development in instructional design and support. Educators might focus on enhancing students' reflective practices and self-assessment skills to foster a more comprehensive understanding of SRL-BL that encompasses all stages of the self-regulation cycle.

This analysis reveals that while students recognize the fundamental components of SRL in blended learning environments, their conceptualizations are skewed toward planning and autonomy, with less emphasis on execution and evaluation. Addressing these gaps through targeted educational strategies could enhance students' self-regulatory skills and contribute to more effective learning outcomes in blended contexts.

3.2 Skills for SRL BL

Regarding the necessary skills for SRL BL, students mention the need for emotional, digital, and distraction management skills (see Table 2). Additionally, students report that self-regulation in learning does not mean dedicating oneself solely to study but making personal and academic life coexist (see Table 2).

The identification of emotional, digital, and distraction management skills reflects a complex understanding of what

self-regulation in BL environments entails. Students appear to be aware that these skills not only facilitate learning but also contribute to their ability to manage stress and maintain a healthy balance between study and personal life. The emphasis on integrating personal and academic life suggests that students view self-regulation as a holistic process. It is not solely about achieving academic goals but about building a lifestyle that supports their overall development. This perspective indicates a mature understanding of self-regulation, where education is part of a broader context of personal growth. This analysis reveals that students perceive self-regulated learning in BL contexts as a multifaceted process requiring emotional, digital, and distraction management skills. Additionally, they emphasize the importance of balancing personal and academic life as an integral part of their learning experience. This comprehensive approach can guide the development of educational strategies that support not only academic success but also the overall well-being of students in blended learning environments.

3.3 Strategies for SRL in BL contexts

Students describe strategies they use to self-regulate their learning in BL educational contexts. These strategies correspond to the three stages of self-regulation in a differentiated manner (see Table 3).

3.3.1 Planning stage

To prepare their study, students indicate developing strategies such as listing tasks, prioritizing tasks, setting goals, organizing evaluations, and self-care actions. The tools used in this process are mainly analog, technological, and virtual, associated with time planning and activity organization (see Table 3). They also mention actions related to maintaining healthy routines, including good nutrition and taking care of rest and leisure spaces.

3.3.2 Execution stage

In the execution stage, students report using self-monitoring strategies such as asking themselves questions and taking formative tests. They also value feedback and help spaces, differentiated into (a) peer instances, (b) with teachers, and (c) online support materials such as tutorials, exercise videos, chat, and specialized forums (see Table 4). Notably, teacher support is mentioned by only one student and in exceptional situations.

In the realm of self-monitoring their learning progress, students indicate that in BL contexts, there are more comparison parameters as their own and peers' performance is visible in the virtual environment, and it is common for professors to use rubrics (see Table 5).

3.3.3 Evaluation stage

Regarding the evaluation stage, students mention strategies that refer to judgment and reaction processes toward their study. Judgments

TABLE 2 Competencies for SRL in BL education scenarios.

Category	Dimension	Analysis unit
Competencies	Emotional	"Able to control frustration, not everything always works (refers to connections and internet and virtual tools)" (E58), "...Stress, knowing how to handle it, when platforms fail... for example you have everything planned and you cannot do anything... you waste time" (E49).
	Digital	"You must have very good knowledge of the use of virtual platforms" (E39), "He easily master's the way of doing virtual work and the necessary platforms, knows the tools and can make the most of the virtual space" (E131)
	Distraction management	"...do not pay attention to social networks, use the cell phone only to look for information and things like that" (E15), "Getting away from everything that is a distraction, so I can concentrate 100% on what I am doing (E30)
	Teleworking (Make study coexist with life)	"I think that a good student regulates himself by having a defined study schedule and his daily life outside of the university" (E22), "...He has a good balance between his studies and his personal life" (E30)

TABLE 3 Planning Strategies Reported by Students in BL Scenarios.

Category	Dimension	Analysis unit
Planning strategies	Listing and prioritization of tasks	"I try to make lists" (E13), "First I identify all the tasks that I must perform, then I order them by priority and/or the time it will take me to complete them and then I use the Pomodoro method" (E135)
	Goal proposal	"Establishing small but clear objectives" (E31), "Establishing more realistic goals according to each person's context" (GF4).
	Organize evaluations	"Use a calendar by setting the tests... schedule the evaluations" (E196)
	Award planning	"Setting small but clear goals which I compensate with small rewards" (E31)
	Self-care actions	"Sleep well" (E28), "The ways I use to regulate is to take study times and rest times (E112)
	Space preparation	"I try to find a comfortable and quiet place to study, a quiet place" (GF2), "I put on calm music and organize the space where I am going to study" (E209)
	Planning time and activities	"Setting schedules where I carry out my activities and defining which activities have the highest priority" (E106)
Planning tools	Analog	"I make a calendar... have a schedule" (E20), "Organizing myself with an agenda" (E118).
	Technological	"... With a stopwatch" (E93), "Normally I set a cell phone timer, a timer, to keep track of the time I use" (E111).
	Virtual	"Google calendar, for example, is a tool that is very useful for organizing activities" (E111), "Saving information in the virtual cloud to have it and read it whenever you want" (E34)

TABLE 4 Execution strategies reported by students in BL Scenarios.

Category	Dimension	Analysis unit
Self-monitoring of learning achievement	Subject questions	"...ask questions about the subject, question" (E9)
	Subject exercises	"I exercise on the subject to check that I am learning" (E220)
	Formative evaluations	"Through virtual flashcards, exams from other institutions, exercises... I evaluate myself" (E71) "Perform diagnostic tests" (E39)
Self-monitoring of the study process	Correct time organization	"I define what I study each day, or if I am deficient in a certain field, I study that field during the schedule of the field that I handle the most" (E40). "I take a break when I lose focus and return 15 min later" (E171)
	Correct study strategy	"He can recognize which methods are useful and apply changes when necessary" (E209)
	Verify completion of activities	"...and I also use a checklist to see what I should study and what I have already studied" (E112) "With everything do list" (E124)
	Manage distractions	"I use earplugs or white noise in the background" (E179)
	Regulates emotions	"He does not get frustrated so quickly if (the study) does not work for him but rather he looks for solutions" (E214)
Seeking help	Of colleagues	"Keeping in touch to support each other, to have a study network, share material and resolve doubts" (E39), "Form a good study group... Ask questions with colleagues using platforms such as Microsoft Teams" (GF4).
	From the teacher	"...talking with classmates and even the teacher himself if necessary" (E54)
	From online materials	"He used digital tools to be able to study what he saw in classes, for example, videos explaining exercises seen in classes or tutorials of programs used." (E24) "...When I do not understand the subject, I look for help on the Internet" (E46).

TABLE 5 Self-monitoring parameters in BL Scenarios.

Category	Dimension	Analysis unit
Personal level of advancement	Amount	"That you can see your progress of what you are learning on the virtual platform" (E18)
Companion advancement level		"I see how my classmates are doing, if I'm late or not... how many they have delivered (refers to the delivery of a task)" (GF2)
Peer learning level	Successes	"It's just that if everyone is pointing at him (refers to giving correct answers) and I'm not, I do not know, it means that something is happening, that I'm missing" (GF7)
	Mistakes	"If you look, and everyone was wrong, then you are not so bad" (GF4)
Ratings	Grades	"Virtual platforms help me check if I handle the content and analyze my notes" (E40) "Be guided by the note" (GF5)
Subject expectations		"It's easier to know what they expect from you...teachers leave you guidelines or rubrics in the virtual classroom" (GF3)

are made about their study processes (materials, technological devices, physical space, study strategies, activity organization, and time planning) and their learning achievement (goals, grades, competencies, knowledge, and learning retention over time).

Students react by developing responses in two areas: their learning and their motivation. For learning, reactions are based on negative events where expected results are not achieved, whereas for motivation, students deploy responses for both good results (praise and rewards) and poor results (self-encouragement and avoidance of pessimistic thoughts) (see Table 6).

The strategies students describe reveal a detailed and differentiated understanding of the stages of self-regulated learning in BL contexts. Planning focuses on establishing a conducive and organized learning environment, emphasizing the importance of balancing study and personal well-being. Execution is characterized by social interaction and the use of online resources, indicating an adaptation to the digital BL environment. Evaluation shows critical self-awareness, where students reflect on their practices and outcomes, adjusting their methods and motivation based on self-assessment. The infrequent mention of teacher support in students' self-regulation strategies underscores a shift toward personalized learning in blended learning

contexts. Students are increasingly proactive in their self-regulation, relying on peer support and digital resources. This adaptability is a key feature of the evolving landscape of blended learning. The analysis reveals that students apply various self-regulated learning strategies in BL environments distributed across the planning, execution, and evaluation stages. These strategies emphasize organization, self-monitoring, and critical reflection, highlighting student autonomy and integrating technological tools and support resources. Fostering these strategies can enhance students' academic success and personal well-being in blended learning environments.

3.4 Differences between SRL-BL and SRL-T

Student narratives highlight differences between SRL-BL and traditional SRL (SRL-T) (see Table 7). In face-to-face education, there is a certain control exerted by the presence of the teacher, helping them concentrate on academic tasks, whereas in a BL context, self-control is required, which is seen as a challenge for SRL BL. In face-to-face education, the responsibility for learning falls on the teacher, while in a BL context, the responsibility shifts to the student, making self-regulation skills more critical.

TABLE 6 Evaluation strategies in BL Scenarios.

Category	Dimension	Analysis unit
Study process	Materials	“I see if I used the notes or materials, maybe I did not have everything I needed” (GF10)
	Devices	“For example, if I had to do a job and I chose an app, maybe I wasn’t the most educated” (E28), “I realized that the computers in the laboratory are super good and so I do the work there” (GF8)
	Physical space	“I studied at a classmate’s house, and it was fatal, a lot of distraction and noise, the slow internet... we did not make any progress” (GF9),
	Study strategy	“Evaluate whether your study methodology was effective” (E225)
	Organization of time and activities	“It was not a good idea, we did a “central attack” and it went badly for all of us” (GF3), “I had distributed the tasks poorly, I gave little time to things that were not so fast” (GF1).
Learning achievement	Goals	“See if it meets the goals it sets” (E215)
	Note	“The grade, the grade tells you how well you did” (GF2)
	Competencies	“If I learned... that, I do know how to do it, apply it” (GF3)
	Knowledge	“You realize how much you handle the subject, then you know, it shows that you handle the subject” (GF6)
	Durability of learning over time	“If you miss the subject, do not forget it the next day” (GF1)
About learning	Review material again	“Understand and analyze failures in my learning by reviewing bad answers” (E238), “Look for weak or strong points and if I have not had a positive result, use another method that improves previous results” (GF1)
	Make decisions to improve your study	“I am looking for another way to study” (GF5), “I modify my study method” (GF6)
About motivation	Self-praise	“I congratulate myself; I tell myself that I am top, that I am the best” (GF3)
	Awards	“...Through self-rewards for meeting small study goals” (E7) “Setting small but clear goals which I compensate with small rewards” (E32)
	Encouraging messages	“I remember the commitment I have to my studies, and I try to motivate myself” (E48)
	Managing negative thoughts	“Put away negative thoughts, so as not to get depressed” (GF2), “You start to think that it is useless, that it is bad, that nothing is going to work for you, but you have to get rid of those thoughts and move on (GF10).

TABLE 7 Differences between SRL-BL and SRL-T.

Category	Dimension	Analysis unit
Responsibility SRL BL	Student	“That it depends on me to learn and use the tools that the university provides me” (E3), “I think it is where learning depends purely on me, deciding whether I want to learn more or less” (E16)
Responsibility SRL T	Teacher	“Trying not to get distracted, it helps to be close to the teacher” (E85), “It’s different, because we are with the teacher and he draws attention, so it regulates us,” (GF3).
Features SRL BL	Level	“The use of the platforms that exist to help level the subject to be learned” (E56), “It helps you understand the subject because if you never get an average...if you do not understand it will not be of any use” (E5)
	Complement	“Use virtual platforms to provide feedback or complement my learning” (E37) “Deepen what is learned in classes, for example, investigate more about a topic” (E177)
	Aid	“Knowing how to use these tools to help yourself in your studies is necessary” (E23).
Features SRL T	Optimize	“You get more out of studying” (GF2), and “you do better because you organize yourself better” (GF3).

In face-to-face study, self-regulated learning (SRL) is implemented through academic activities provided by the teacher. In contrast, in SRL-BL, the student defines what and how to study, adapting it to their own needs. Related to this idea, SRL-BL is seen as a skill that levels, complements, and/or aids learning, leading to additional study actions required in a face-to-face context (see Table 7). From the students’ narratives, it is inferred that the virtual component favors SRL by providing a global view of the learning process and the academic load it will entail, which in face-to-face learning is limited to a more linear view of the learning process discovered class by class. This global view of the learning process particularly favors SRL BL in its execution stage (see Table 7).

The perceived differences between SRL-BL and SRL-T highlight a significant shift in the dynamics of responsibility and control in the learning process. In traditional environments, the external control provided by the teacher structures learning, whereas in BL, students must take a more active and autonomous role. This shift toward self-regulation in BL implies that students need to develop and apply planning, execution, and evaluation skills independently. The ability to adapt learning to their personal needs and the global view of the learning process in BL can facilitate a richer and more personalized learning experience. The analysis reveals that students perceive SRL-BL as an approach that requires more advanced and autonomous self-regulation skills compared to SRL-T. The need for self-control and personal responsibility in BL challenges students to become more

TABLE 8 Threats to SRL-BL.

Category	Dimension	Analysis unit
Distractors	Social networks	“Not paying attention to social networks, using the cell phone only to search for information and things like that” (E14), “He takes his time to disconnect from social networks and focuses on his studies and learning” (E22)
	Leisure technologies	“Ability to resist temptations such as the telephone, the computer” (E41) “He does not lose concentration or is distracted by Instagram-type applications or pages” (E132)
	Daily activities	“Getting away from everything that is a distraction... a good balance between your studies and your personal life” (E29)
	Organization of the virtual environment	“Have your virtual space organized while worrying about possible distractions” (E20)

independent learners. At the same time, the flexibility and global view of learning in BL contexts offer opportunities for more effective self-regulation and adaptive learning. Fostering these skills can enhance learning effectiveness and prepare students for more self-directed educational environments.

3.5 Threats to SRL BL

The main threat perceived by students to SRL BL is distraction. Students express that concentrating in a virtual learning environment is more difficult, making it more complex to adhere to study planning, requiring additional effort. For students, the BL scenario presents a learning context with new challenges where factors such as social networks, leisure technologies (TV, consoles, among others), personal activities, and the disorganization of the virtual environment become threats to SRL (see Table 8).

Students' perceptions of threats to SRL in BL contexts highlight the importance of a structured and distraction-free learning environment for successful self-regulation. The presence of multiple sources of distraction in the virtual environment challenges students to develop effective strategies to maintain concentration and adhere to their study plans. The need for additional effort to manage distractions suggests that students must be more conscious and deliberate in implementing self-regulation strategies in BL contexts. This includes setting clear boundaries for the use of leisure technologies and social networks, as well as creating an organized study environment that minimizes distractions.

The analysis reveals that distractions pose a significant threat to self-regulated learning in BL contexts, requiring conscious effort from students to stay focused and adhere to their study plans. Fostering self-regulation skills that specifically address these distractions can enhance learning effectiveness and help students face the unique challenges of blended learning environments.

4 Discussion

Discussing self-regulated learning in blended learning (SRL-BL) environments is not only relevant for the academic development of students but also for the continuous evolution and improvement of modern educational methods (Gqibani, 2022). This study aimed to conceptualize self-regulated learning in university educational contexts with a B-L modality, based on students' perceptions.

The SRL-BL is defined as a process in which students structure, monitor, and evaluate their learning using both self-reflection and digital technologies. Students describe this process following the

same three stages of traditional SRL: planning, execution, and evaluation, although with a notable emphasis on planning and, to a lesser extent, on execution, while the evaluation stage receives less attention. SRL-BL is also perceived as synonymous with autonomous learning, highlighting the student's independence and the effective use of virtual platforms to organize their studies.

Self-regulated learning promotes autonomy and responsibility in students, crucial skills for their academic and professional success. In blended learning environments, where face-to-face teaching is combined with online instruction, these skills become even more important (Zimmerman, 2000). The results show that students understand SRL-BL as an integral process of self-reflection and action, structured in three stages: planning, execution, and evaluation, but with particular emphasis on the first two. This understanding reflects an adaptation of the traditional self-regulated learning model to the blended learning context, where digital technologies play a crucial role.

The lesser focus on the evaluation stage suggests a possible area for improvement in training students for more complete and effective self-regulation. This aligns with findings from other research indicating low metacognitive processes due to a lack of training in metacognition. Metacognition is often not a central component of the curriculum in many educational institutions. Students may not be familiar with effective self-assessment techniques, such as critical reflection, the use of rubrics or checklists, and self-observation. Another influencing factor is that in many educational systems, evaluation is traditionally centered on teachers and standardized tests, which can prevent students from developing self-assessment skills. If students do not see the value of self-assessment or are not motivated to reflect on their learning, they are less likely to develop metacognitive skills.

4.1 Necessary skills for SRL-BL

For SRL-BL, students identify emotional, digital, and distraction management skills, as well as the ability to balance study with personal life, highlighting the multifaceted nature of SRL-BL. These skills are essential to face the specific challenges of learning in mixed environments, where the physical presence of the teacher and the traditional classroom structure are largely replaced by the student's autonomy and the use of digital tools.

Regarding emotional skills, virtual education can increase isolation and reduce social support, favoring feelings of loneliness and anxiety. High levels of stress and frustration can particularly decrease motivation and commitment to studies. Students may feel overwhelmed and demotivated, leading to procrastination behaviors that affect their academic performance. Similarly, various studies

(Avdija, 2022; Hinds and Sanchez, 2022; Knezevic et al., 2023) indicate that stress and frustration negatively affect concentration, memory, and decision-making capacity.

Research during the pandemic period (Hodges et al., 2020) indicates that one of the obstacles identified by students for good performance in virtual education is the excessive workload, its poor distribution, and the lack of prioritization among the types of resources contained in virtual classrooms for learning. A well-planned curriculum of the academic load assigned to students, with a better balance in the amount and types of academic commitments, would stimulate a less stressful and frustrating learning environment that favors participation, information retention, and overall satisfaction with the educational experience.

Concerning the above, self-care behaviors mentioned by students (sleep care, nutrition, and leisure spaces) could be measures to combat stress and frustration. When these are absent, there is a greater likelihood of negative effects on physical health, such as insomnia, headaches, and other health problems. Similarly, another measure declared as relevant by students was the ability to maintain a healthy balance between academic responsibilities and personal life, a challenge associated with greater overall well-being.

In the case of digital skills, students highlight the mastery of virtual platforms and digital tools as a necessary aspect, implying that educational institutions must ensure students receive adequate training in these competencies (Afify et al., 2023). Additionally, including digital competencies in higher education is crucial for the current job market, where these skills are essential for almost all professions, bridging the gap between education and market demands, ensuring a workforce prepared for the challenges and opportunities of the 21st century, and driving economic and social development.

Finally, effective self-regulation requires students to learn to manage distractions, a significant challenge in virtual learning environments where social networks and other leisure technologies are constantly available (Turnbull et al., 2023). In this scenario, being able to create an appropriate study space (without TV, loud noises, constant traffic, etc.), having a fixed study schedule can help maintain discipline, turning off notifications on the phone and other electronic devices, or using applications that block access to social networks and websites unrelated to study during work hours, keeping the digital desk tidy, closing unnecessary tabs and using applications and tools that help maintain focus, such as task list apps and time managers, even communicating needs to family, friends, and peers to ask them to respect those times to minimize interruptions. Using active study techniques like taking notes, making summaries, and participating in online discussions can keep the mind active and engaged with the study material. This together would help students better manage distractions and create a more productive learning environment.

4.2 Strategies for self-regulated learning in blended learning contexts

The strategies for SRL-BL mentioned by students are abundant and varied, indicating that the experience with virtuality has significantly transformed how university students' study. Some examples include the increased possibility of collaborative study through tools like Google Docs, Microsoft Teams, and Slack, which allow students to work together in real-time regardless of geographic distance. Multimedia materials like videos, podcasts, and others enrich learning and enable students to access information in different formats. Virtual and

augmented reality allow students to participate in simulations and conduct experiments in a safe and controlled environment. Immersive technologies offer more interactive and engaging learning experiences, which can improve the understanding of complex concepts. Despite all these opportunities provided by technologies, they can also maintain and/or exacerbate existing gaps among students, as not all possess the necessary skills to successfully face these challenges, including SRL skills.

In SRL-BL, students mention the use of analog and digital tools for planning, suggesting that students combine traditional methods with modern technologies to manage their learning, resulting in a greater repertoire of strategies for SRL. These strategies give students more opportunities to anticipate the study strategy that might be most favorable, estimate the effort it will require, evaluate its complexity to visualize additional support needs, all desired behaviors that favor academic success.

In the execution stage, students report implementing self-monitoring strategies that focus on learning achievement, how the study process is carried out, and seeking help. The self-monitoring and help-seeking strategies reflect a deep understanding of the importance of continuous reflection and collaborative support. The lesser mention of teacher support may indicate greater autonomy, but it also suggests that teachers need to be more available to assist when necessary (Trespalcacios et al., 2021). Finally, in the evaluation stage, students express developing some judgment and reaction processes. Self-judgment and reaction strategies highlight the importance of critical reflection on the learning process and the adaptation of strategies based on the results obtained. It is worth noting that in the reaction processes, strategies associated with addressing motivational cognitive states appear, such as setting aside negative thoughts in response to a learning failure evaluation or self-reward in the case of success, aspects less considered in the conceptualization of SRL and therefore little considered in programs aiming to promote it.

4.3 Differences between SRL-BL and SRL-T

The perceived differences between SRL-BL and SRL-T highlight the central role of the student in their learning in a BL environment. In face-to-face education, the presence of the teacher provides greater structure and supervision, whereas in BL education, the student must take on more responsibility. This implies that students need to participate more proactively and autonomously in their learning, developing self-management and self-control skills that are less demanded in a traditional environment where the teacher more actively regulates learning (Ryan and Deci, 2017). Consequently, in SRL-BL, students need to have a more comprehensive view of their learning process and the academic load it generates, facilitating better planning and execution of their studies compared to face-to-face education, where the learning process is discovered more linearly and sequentially.

4.4 Threats to SRL-BL

The main threat identified for SRL-BL by students is distraction. Virtual environments present numerous distractors, such as social networks, leisure technologies (television, video game consoles), everyday activities, and the disorganization of the virtual environment (Aristovnik et al., 2020). These factors make it difficult to concentrate and adhere to study planning, requiring extra effort to maintain

self-regulation of learning in BL contexts. These distractions can reduce the effectiveness of learning and increase the effort needed to stay focused and follow study plans. This would be a cross-cutting threat present throughout the entire SRL cycle, regardless of the stage.

The study's results underscore the complexity of self-regulated learning in BL environments, highlighting both the necessary competencies and the challenges students face. Educational institutions must consider these findings to design interventions and supports that strengthen SRL-BL. The results highlight the need to provide training instances for students that include both digital skills and strategies for managing stress and frustration associated with online education.

Despite the fact BL promotes a role for students with greater autonomy and independence, the teacher's role remains fundamental in the learning process. It is necessary to emphasize that teaching in digital environments does not seek to eliminate the teacher's role but to optimize this relationship through more channels and means of teaching. This allows activities with active methodologies to be carried out during synchronous and/or face-to-face sessions, where the teacher can convey expectations, attitudes, values, experiences, and expertise, aspects that are difficult to teach otherwise.

It is important to note that the number of cases in this study is limited, which restricts the scope of its results. This is particularly sensitive in analyzing the differences that SRL-BL might present between areas of knowledge and/or educational levels of students. Future research should expand and diversify participants (e.g., students who are not in their first year of study, from different educational levels and different areas of science) to enrich knowledge on this topic and delve into the specific strategies that students deploy to increase the effectiveness of SRL. Current instruments that measure SRL do not consider virtual environments or new technologies, making them outdated. Future studies could focus on developing and studying the psychometric characteristics of instruments that measure SRL-BL, providing the opportunity for experimental designs to estimate the impact of SRL-BL intervention programs and identify the most effective strategies.

5 Conclusion

It is concluded that it is crucial to update the concept of self-regulated learning in an educational setting that has been impacted by technological advancements. Attention must be given to the new challenges students face in achieving a good level of SRL-BL and the strategies they are using to address these challenges.

The study has conceptualized the process of SRL-BL environments, where students structure, monitor, and evaluate their learning using self-reflection and digital technologies. It has been observed that students follow the traditional stages of planning, execution, and evaluation, although with a particular emphasis on planning and less on evaluation. This adaptation reflects the student's independence and the effective use of virtual platforms to organize their studies.

Significant differences have been identified between SRL-BL and SRL-T. In face-to-face education, the presence of the teacher provides greater structure and supervision, while in B-L education, the student assumes greater responsibility and autonomy. This implies that students need to participate more proactively in their learning, developing self-management and self-control skills that are less demanded in a traditional environment. SRL-BL requires a more

comprehensive view of the learning process and better planning due to the physical absence of the teacher to actively regulate learning.

Among the identified benefits are the promotion of autonomy and responsibility in students, crucial skills for their academic and professional success. However, students face significant obstacles such as distraction caused by social networks, leisure technologies, and the poor organization of the virtual environment. These factors negatively affect concentration and adherence to study planning, requiring additional strategies to effectively manage self-regulated learning in B-L contexts.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The study was authorized by Comité de Ética, Bioética y Bioseguridad of Universidad de Concepción, whose identifier code is CEBB 1099-2022. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

KL: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. RC-R: Investigation, Methodology, Validation, Visualization, Writing – original draft, Writing – review & editing. DB: Conceptualization, Investigation, Writing – original draft, Writing – review & editing. JS: Investigation, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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