

# Examining the Readiness of University Students toward Self-regulated Online Learning: Implications for Higher education

Heba Salam, Imane Abou Ali

Lebanese University, Faculty of Education

[hebasalam28@gmail.com](mailto:hebasalam28@gmail.com), [imane.abuali@gmail.com](mailto:imane.abuali@gmail.com)

## Abstract

Within the rapid growth of online learning, particularly Massive Open Online Courses (MOOCs), students are increasingly required to regulate their learning independently. The aim of this study is to examine the readiness of university students toward self-regulated online learning; Accordingly, we raised the corresponding main research question: Till which extent are university students ready toward the self-regulated online learning, in terms of its five aspects? A quantitative - descriptive research was employed using a reliable and valid questionnaire for self-regulated online learning (SOL-Q), which is made up of 36 items, divided into 5 axes (metacognitive skills, time management, environmental structuring, persistence, and help seeking). The SOL-Q was distributed to 104 private university students in Beirut. Results showed that 78.5% of the students had weak metacognitive skills, 9.62% were moderate and 11.54% were strong. In terms of time management 49.04% struggled, 31.7% had moderate skills, and 19.23% managed time well. For environmental structuring 63.46% showed high ability, 12.5% moderate and 24.04% don't know how to prepare their settings for online learning. Persistence was also low, with 67.31% showing weak levels, 26.92% moderate, and only 5.77% high. Concerning help seeking 76.92% actively sought help, 6.73% did so moderately, and 16.35% did not seek help. As self-regulated learning is increasingly important in open online learning, the findings highlight the need to support students in developing metacognitive skills, effective time management, and persistence. These elements are essential for enhancing learning autonomy and improving outcomes in digital education environments.

## Keywords

Self-regulated learning, online learning, metacognition, university students

## المستخلص

في ظل النمو السريع للتعليم عبر الإنترنت، وخاصة المساقات المفتوحة واسعة النطاق (MOOCs)، يُطلب من الطلاب بشكل متزايد تنظيم تعلمهم بشكل مستقل. تهدف هذه الدراسة إلى قياس مدى جاهزية طلاب الجامعات للتعلم الذاتي المنظم عبر الإنترنت، وذلك من خلال طرح سؤال البحث الرئيسي: إلى أي مدى يُعدّ طلاب الجامعات جاهزين للتعلم الذاتي المنظم عبر الإنترنت من حيث جوانبه الخمسة؟ استخدمت الدراسة منهجاً كمياً وصفيّاً، بالاعتماد على استبيان موثوق وصحيح يُعرف بـ (SOL-Q) ويتكون من 36 سؤال موزعين على خمسة محاور: مهارات ما وراء المعرفة، إدارة الوقت، تنظيم البيئة التعليمية، الإصرار، وطلب المساعدة. وُرّع الاستبيان على 104 طلاب من جامعة خاصة في بيروت. أظهرت النتائج أن 78.5% من الطلاب لديهم مهارات ما وراء المعرفة ضعيفة، و9.62% بمستوى متوسط، و11.54% بمستوى جيد. أما إدارة الوقت، فقد واجه 49.04% صعوبة فيها، و31.7% أظهروا مستوى متوسطاً، و19.23% أداروا وقتهم بشكل جيد. وبالنسبة لتنظيم البيئة التعليمية، أظهرت النتائج 63.46% لديهم قدرة عالية، و12.5% لديهم قدرة متوسطة، في حين أن 24.04% لم يعرفوا كيفية تهيئة بيئتهم للتعلم. وكان معدل الإصرار منخفضاً أيضاً، حيث 67.31% أظهروا مستويات ضعيفة، و26.92% متوسطة، و5.77% فقط مرتفعة. أما فيما يخص طلب المساعدة، ف76.92% كانوا نشطين في طلبها، و6.73% بدرجة متوسطة، و16.35% لم يطلبوا المساعدة. تؤكد النتائج على أهمية دعم الطلاب لتطوير مهارات ما وراء المعرفة، وإدارة الوقت الفعالة، والإصرار، لما لهم من دور جوهري في تعزيز الاستقلالية وتحسين نتائج التعلم في البيئات الرقمية.

## كلمات مفتاحية

التعليم الذاتي المنظم، التعليم أونلاين، مهارات ما وراء المعرفة، تلامذة الجامعة

## Résumé

Avec la croissance rapide de l'apprentissage en ligne, surtout des cours en ligne ouverts et massifs (MOOC), les étudiants sont de plus en plus appelés à réguler leur apprentissage de manière autonome. Cette étude vise à évaluer la préparation des étudiants universitaires à l'apprentissage en ligne autorégulé. Une recherche quantitative et descriptive a été menée à l'aide d'un questionnaire valide et fiable, le *Self-Regulated Online Learning Questionnaire* (SOL-Q), composé de 36 items répartis sur cinq axes: compétences métacognitives, gestion du temps, structuration de l'environnement, persévérance et recherche d'aide. Le questionnaire a été distribué à 104 étudiants d'une université privée à Beyrouth. Les résultats ont révélé que 78,5 % des étudiants avaient de faibles compétences métacognitives, 9,62 % un niveau modéré, et 11,54 % un niveau élevé. Concernant la gestion du temps, 49,04 % avaient des difficultés, 31,7 % un niveau modéré, et 19,23 % géraient bien leur temps. Pour la structuration de l'environnement, 63,46 % ont démontré une grande capacité, 12,5 % un niveau modéré, et 24,04 % ne savaient pas organiser leur espace d'apprentissage. La persévérance était également faible : 67,31 % affichaient un niveau bas, 26,92 % modéré, et seulement 5,77 % un niveau élevé. En ce qui concerne la recherche d'aide, 76,92 % y avaient recours activement, 6,73 % modérément, et 16,35 % ne la sollicitaient pas. Ces résultats soulignent l'importance de renforcer chez les étudiants les compétences métacognitives, la gestion du temps et la persévérance pour favoriser l'autonomie et la réussite dans les environnements d'apprentissage numérique.

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## Mots-clés

Apprentissage autorégulé, apprentissage en ligne, métacognition, étudiants universitaires

## 1 Introduction

Distance education is increasingly giving way to more adaptable and accessible learning models; the global shift toward online learning has brought about enormous changes to the educational landscape. Massive Open Online Courses (MOOCs) are one of them that has become a well-known instrument for creating sustainable learning environments. However, this requires students to be more independent and self-regulated. Pintrich (2000) defines self-regulated learning as the process by which learners actively and constructively set goals and regulate their cognition, motivation, and behavior to achieve their learning outcomes.

Accordingly, it's a crucial skill in online learning, where learners often have greater autonomy and responsibility for their education.

However, in order to succeed academically, socially, emotionally, and professionally, SRL promotes the development of important abilities like motivation, metacognition, and strategic thinking. The necessity for educational policies and systems that successfully promote the development of self-regulated learning behaviors is highlighted by the fact that, despite its transformative potential, many students still struggle with this skill.

Academic achievement is positively related to SRL, particularly metacognitive regulating behaviors like monitoring and planning (Dent & Koenka, 2016). Accordingly, determining the factors related to students' self-regulation effort is vital for a successful distance learning process.

The internal individual factors of learners, as well as external training and intervention contribute to differences in SRL ability among learners

An important determining aspect is personal motivation to study. Motivation can shape results and has a favorable correlation with SRL (Lim and Yeo, 2021). According to Hromalik and Koszalka (2018), students who succeed in online learning have high levels of intrinsic motivation, especially emotional drive. As students reflect, they will think about and modify their own learning strategies and be able to better manage their time. Students who have low learning outcomes are less motivated, and blame outside influences for their low learning achievements. Learning motivation and self-regulation are mutually reinforcing; persistence, one of the components of self-regulated online learning, is closely linked to emotional drive. According to a study published in the *Journal of Behavioral Decision Making*, persistence is significantly influenced by people who have great emotional motivation.

Furthermore, SRL is influenced by self-efficacy. Self-efficacy can be defined as that one can achieve specific tasks and objectives (Bandura, 1997). Higher self-efficacy learners are more likely to dedicate themselves to their studies and practice self-regulating behaviors (Csizér and Tankó, 2017; Sardegna et al., 2018). Self-assessment skills predict learners' self-efficacy in speaking, listening, and reading; goal-setting influences their writing efficacy; and environmental organizing skills influence their speaking and writing efficacy (Su et al., 2018). This has a clear connection to three elements of self-regulated online learning: time management, environmental structuring, and metacognitive skills, of which goal setting is one. Moreover, students' capacity for self-control will be impacted by outside variables like directing and interfering with the online learning process. Helping students acquire the ability to self-regulate their learning is essential since these students do better academically. Research has demonstrated that giving students advice on learning strategies might enhance their academic performance and self-control (Bandalos et al., 2003). Help-seeking is a component of self-regulated learning that is intimately tied to this.

The connection between self-efficacy and metacognitive techniques was examined in another study that was published in the Journal of Behavioral Decision Making. The study discovered that the application of planning techniques, which are essential to metacognitive abilities, was positively impacted by self-efficacy. By defining explicit goals and structuring their learning activities, students with higher self-efficacy were better able to monitor and alter their learning techniques, so enhancing their overall learning results.

Moreover, self-efficacy has been demonstrated to improve time management abilities in an online learning environment. A study that was published in the Journal of Interactive Online Learning proved how academic self-efficacy was affected by self-regulated learning techniques. The results indicated that students who had confidence in their talents were more likely to use time management strategies that work, like goal-setting and schedule adherence, which are critical for success in online learning settings.

Environmental structuring, an aspect that involves setting up one's digital and physical learning environments to reduce distractions, also depends on self-efficacy. Higher self-efficacy learners are more proactive in establishing supportive learning environments, according to research, which encourages perseverance and long-term involvement in online learning.

Furthermore, a number of elements influence the success of online courses, and one of the most important ones is student satisfaction (Hamdan et al., 2021; Wei & Chou, 2020). Furthermore,

a study involving 1232 Vietnamese university students found that student loyalty and satisfaction were positively impacted by the caliber of e-learning services (Pham et al., 2019). Although it is not the sole determinant, student satisfaction is one of the important indications for the effectiveness of online programs (Yukselturk & Yildirim, 2008), supporting high-quality education that aligns with Sustainable Development Goal #4.

## 1.1 Research Problem

The transition to online learning has become a global phenomenon, accelerated by the increasing demand for flexible and accessible education systems. As universities adopt online learning platforms, fostering self-regulated learning (SRL) skills among students becomes crucial for ensuring academic success and sustainability in education. Self-regulated learning (SRL) in online environments refers to a learner's ability to independently manage their learning process, including planning, monitoring, and evaluating their progress. Moreover, the growing emphasis on global curricula and sustainable teaching-learning systems highlights the urgent need to equip university students with essential skills for self-regulated online learning. However, it remains unclear whether students are adequately prepared to adopt this learning approach. Self-regulated learning encompasses five critical aspects: metacognitive skills, time management, environmental structuring, persistence, and help seeking. Examining students' readiness in these areas is crucial to identifying which aspects require immediate attention and improvement. This understanding will not only help in preparing autonomous and independent learners but also enhance the overall efficacy of online learning. Furthermore, by exploring students' readiness for self-regulated online learning, we can identify strategies to foster interdisciplinary research integration, improve the quality of education, and shape educational policies that support sustainable and equitable learning environments.

Many students still struggle with certain behaviors, which emphasizes the necessity of educational policies and procedures that efficiently facilitate the development of these skills. She examined how gender affected high school students' use of self-regulated online learning (SROL) during the COVID-19 lockdown in China in her work (Liu et al., 2021). The results showed that in every phase—preparatory, performance, and appraisal—females demonstrated greater self-regulation than males. In particular, women were better at controlling their emotions, organizing their classroom, applying task techniques, efficiently managing their time, and evaluating themselves and asking for assistance. These findings imply that the effectiveness of self-regulated online learning is significantly influenced by gender.

There is a research gap, nevertheless, as no study have looked at how university students' educational level—whether they are first-, second-, third-, graduate-, or master's students—affect their readiness for self-regulated online learning.

In the context of Lebanon, we would like to know if educational level and gender can be regarded as determining variables in our university students' readiness for self-regulated online learning.

In order to determine whether university students' gender and educational level—whether they are first-, second-, graduate- or master's students—are influencing their preparedness for self-regulated online learning, this study examined not only university students' readiness for SROL in terms of its five components but also whether gender and educational level of the students affect such readiness.

## 1.2 Research Questions

### Research questions #1:

Till which extent are university students ready toward the self-regulated online learning, in terms of its five aspects (metacognitive skills, time management, environmental structuring, persistence and help seeking)?

### Research question # 2:

Is gender of the university students considered a factor that controls their readiness toward self-regulated online learning?

### Research question #3:

Is educational level of university students considered a factor that controls their readiness toward self-regulated online learning?

## 1.3 Aim of the study

This study investigates the readiness of university students for self-regulated online learning (SROL), in terms of its five aspects. (metacognitive skills, time management, environmental structuring, persistence and help seeking), and to examine whether the gender of the students and their educational level are considered as factors that control their readiness toward self-regulated online learning.

## 1.4 Significance of the study

This research, which examines the readiness of university students toward self-regulated online learning, is significant for several reasons.

First, it provides insights into students' readiness across key SRL dimensions, including metacognitive skills, time management, environmental structuring, persistence, and help-seeking. Understanding these aspects is essential for identifying gaps in readiness and for designing targeted interventions to enhance students' ability to independently manage their learning. Second, by addressing these gaps, this research contributes to the development of autonomous learners who can thrive in diverse and dynamic online learning environments.

Moreover, the findings will offer valuable guidance for policymakers and educators, enabling them to integrate evidence-based strategies into teaching practices and curriculum design. This will not only improve the efficacy of online learning but also support the broader goal of creating sustainable, equitable, and lifelong learning systems. By exploring readiness and identifying areas for improvement, this study will contribute to shaping educational policies that prioritize quality education and prepare students for the demands of a global, interconnected world.

## 1.5 Theoretical & conceptual Framework

Self-regulated learning theory SRL theory attends to the development of three learning processes: metacognition, motivation, and strategic action (Winne & Perry, 2000; Zimmerman, 2008). Metacognitive learners are aware of their personal learning strengths and challenges. They have knowledge of learning strategies and are attuned to others' needs and interests. Motivated learners are willing to attempt challenging tasks. They are persistent and believe that, with effort, they will succeed within learning tasks. Finally, strategic learners have large repertoires of learning strategies. They are adaptive and flexible in their use of strategies and able to adjust strategies to meet the needs of various tasks (Zimmerman, 2002). Zimmerman's SRL model identifies three phases of SRL: the forethought phase, during which learners set goals for themselves, assess their motivation and abilities to complete the tasks, and make plans for engaging in the task; the performance phase, when learners focus their attention, engage in tasks, develop and apply strategies, and monitor their progress, and the self-reflection phase, when learners reflect upon the task and their performance through self-evaluation. Butler and Cartier's (2018) model of SRL includes a sociocultural lens that links historical, cultural, social, and community contexts to it. While differing in scope, all SRL models emphasize the

importance of iterative cycles of planning (forethought), enacting, reflecting, and adjusting thoughts and actions to achieve learning goals.

Aligned with Vygotskian theory (1978), self-regulation encompasses personal and social forms of learning. The cognitive and metacognitive processes of self-regulation are modeled and internalized through social interactions; this co-regulation with others fosters SRL in learners (McCaslin, 2009). Socially shared regulation expands upon the notion of co-regulation, referring to the regulation of common learning objectives shared within groups to achieve agreed upon goals (Hadwin et al., 2018).

Three fundamental psychological needs have been identified by research within the self-determination theory: autonomy, competence, and relatedness (Ryan and Deci, 2000, 2017). These needs have been demonstrated to be significant for people's motivation, well-being, life satisfaction, and vitality on a daily and general level (e.g., Reis & Gable, 2000). A growing number of studies (reviewed in Van den Broeck et al., 2016; Deci et al., 2017) have applied self-determination theory to the workplace, and these studies generally align with the elements of self-regulated learning.

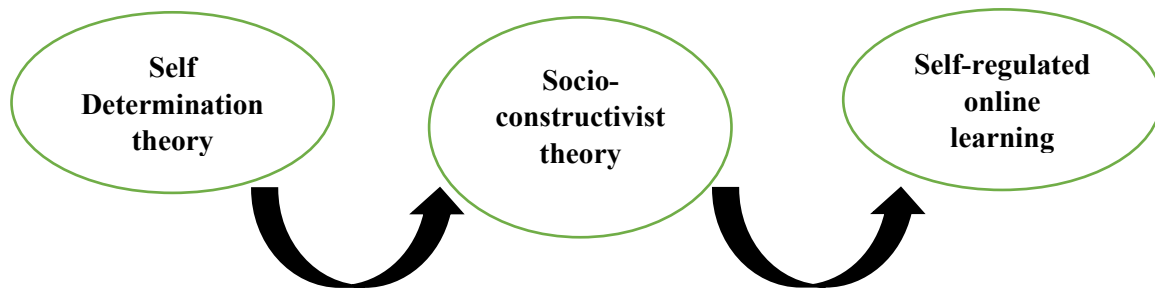
Integrating SRL, SDT, and socio-constructivist theories provides a comprehensive framework for understanding students' readiness for self-regulated online learning. This integrated approach considers the interplay between individual motivation, cognitive strategies, and social context. Studies have shown that students who perceive support for autonomy, competence, and relatedness are more likely to employ effective SRL strategies and achieve better learning outcomes in online settings.

Building on this, Self-Regulated Learning Theory focuses on how learners plan, monitor, and evaluate their own learning processes—skills that are essential in the relatively autonomous environment of online education. Vygotsky's Socio-Constructivist Theory complements these views by highlighting the importance of social interaction and scaffolding in cognitive development, even within digital learning contexts. Together, these theories suggest that university students' readiness for self-regulated online learning is not only a matter of individual motivation and metacognitive skills, but also shaped by the social and instructional support structures present in the learning environment. This integrated framework allows for a holistic examination of the cognitive, motivational, and contextual factors influencing students' preparedness for independent online learning.



Thus, our conceptual framework for this study is grounded in three interrelated theoretical perspectives: Self-Determination Theory (SDT), Self-Regulated Learning (SRL) Theory, and Socio-Constructivist Theory, particularly as articulated by Vygotsky. Self-Determination Theory provides a foundational lens through which students' motivation for online learning is understood, emphasizing the roles of autonomy, competence, and relatedness in fostering intrinsic motivation

**Figure 1:** Conceptual framework of the study



## 2 Methodology

The study was designed as quantitative –descriptive research and focuses on collecting quantitative data to investigate the readiness of university students for self-regulated online learning and two factors that may affect such readiness.

### 2.1 Sample

The sample chosen is 104 private university students in Beirut. The descriptive statistics of the students showed in table 1

**Table 1:** Students' Characteristics.

| Variable          | Categories        | Frequency | Percent |
|-------------------|-------------------|-----------|---------|
| Gender            | Female            | 66        | 63.5 %  |
|                   | Male              | 38        | 36.5%   |
| Educational level | First Year        | 6         | 5.8%    |
|                   | Second Year       | 14        | 13.5%   |
|                   | Third Year        | 12        | 11.5%   |
|                   | Graduated         | 34        | 32.7%   |
|                   | Master's Students | 38        | 36.5%   |

## 2.2 Instrument

A valid self-regulated online learning questionnaire (SOL-Q) was used for data collection. (Appendix A). SOL-Q consists of 36 items (questions) with a 7-points Likert scale, distributed on five factors (see appendix) Metacognitive skills, time management, environmental structuring, persistence, and help seeking. Table 2 showed the descriptive statistics of the five factors.

- **Reliability of the questionnaire**

SOL-Q is a scale consists of 36 items divided into 5 scales. The reliability analysis of the 5 scales are below:

**Note:** Cronbach Alpha of reliability should be at least 0.7, a value of Cronbach alpha less than 0.7 means that the scale is not reliable.

**Table 2:** Test of Reliability

| Scale                     | Items          | Number of Items | Cronbach's Alpha |
|---------------------------|----------------|-----------------|------------------|
| Metacognitive skills      | 1,2,...,17,18  | 18              | 0.955            |
| Time management           | 19,20,21       | 3               | 0.864            |
| Environmental structuring | 22,23,24,25,26 | 5               | 0.903            |
| Persistence               | 27,28,29,30,31 | 5               | 0.943            |
| Help seeking              | 32,33,34,35,36 | 5               | 0.883            |

The scales showed good internal consistency (Cronbach's  $\alpha > 0.7$ ), indicating that the items reliably measure the same construct within each scale.

| Cronbach's Alpha | Interpretation |
|------------------|----------------|
| > 0.9            | Excellent      |
| > 0.8            | Good           |
| > 0.7            | Acceptable     |
| > 0.6            | Questionable   |
| > 0.5            | Poor           |
| < 0.5            | Unacceptable   |

Source: George & Mallery (2003)

## 2.3 Data collection/procedure

To maintain anonymity and confidentiality, the Student Online Learning Questionnaire (SOLQ) was prepared using Google Forms without requesting personal information. After obtaining permission from three private universities in Beirut, class delegates helped distribute the questionnaire to students via official WhatsApp groups. A total of 104 university students

were invited to participate, with an average completion time of 20 minutes. Responses were collected through Google Forms and exported as an Excel file for further analysis.

## 2.4 Data analysis

The cleaned dataset was imported into multiple statistical software tools for comprehensive analysis:

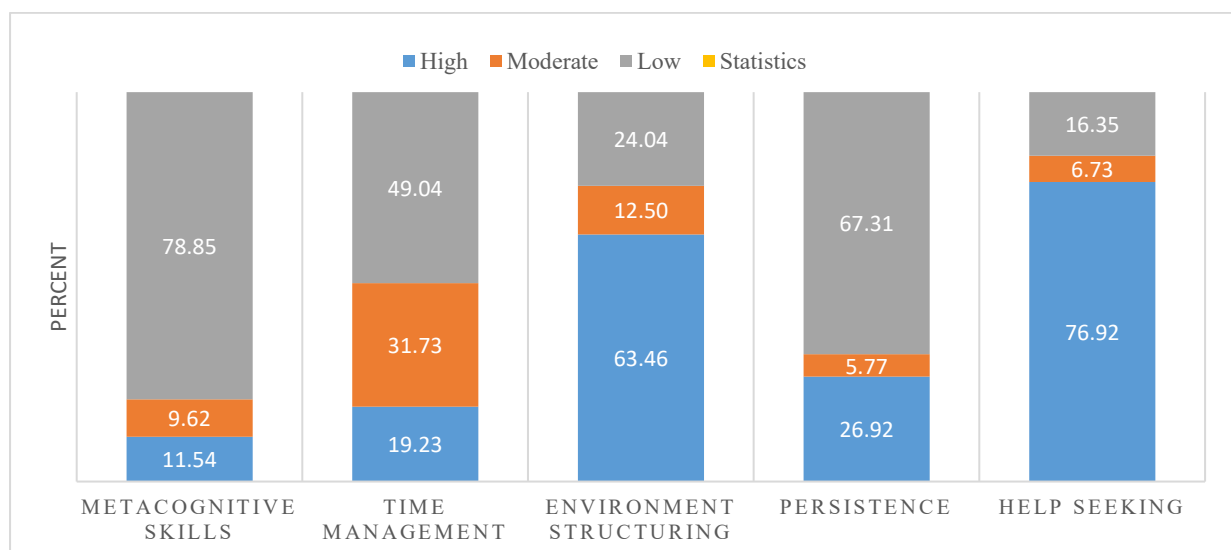
- SPSS (Statistical Package for the Social Sciences) was used for descriptive statistics such as means, frequencies, and standard deviations.
- JASP was employed to perform inferential statistics and hypothesis testing due to its user-friendly interface and Bayesian analysis capabilities
- Python was used for advanced statistical modeling and data visualization.

## 3 Results

### 3.1 Descriptive statistics of Self-regulated online learning Questionnaire (SOL-Q): Based on SPSS software

The scores of the students on the five factors classified into three levels (categories) low, moderate, and high scores based on their scores range. A score less than 3.58 considered low, a score between 3.58 and 4.44 considered moderate, while a score greater than 3.44 considered high. Figure 2 show the descriptive statistics of factors after classification.

**Figure 2:** Bar plot of classification of students' scores



For the metacognitive skills scores, 82 students (78.85%) were classified as having low skills, 10 (9.62%) as moderate, and 12 (11.54%) as high metacognitive skills. While, for time

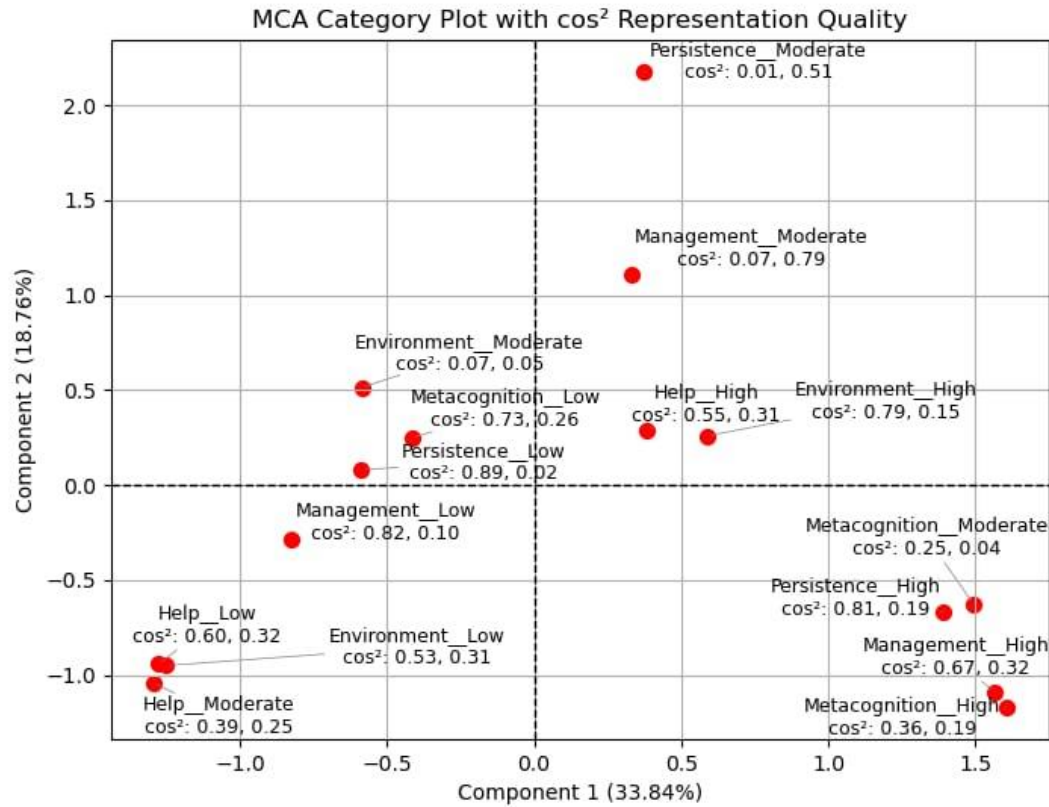
management scores, 51 students (49.04%) were classified with low management, 33 (31.73%) with moderate, and 20 (19.23%) classified with high time management. Moreover, 25 students (24.04%) were classified with low environmental structuring, 13 (12.50%) with moderate, and 66 (63.46%) with high environmental structuring. Also, 70 students (67.31%) were classified with low persistence, 6 (5.77%) with moderate, and 28 (26.92%) with high persistence. Finally, 17 students (16.35%) were classified with low help seeking, 7 (6.73%) with moderate, and 80 (76.92%) with high help seeking.

### **3.2 Multiple Correspondence Analysis of SOL-Q categories (Based on Python software)**

A Multiple Correspondence Analysis (MCA) was conducted to explore the associations among the categorical variables of self-regulated online learning questionnaire (learning strategies). The variables (strategies) are metacognitive skills, time management, environmental structuring, persistence, and help seeking. Each strategy consists of three levels (low, moderate, high). The MCA reduces the dimensions to visualize the fifteen categories of the five strategies in a two-dimensional space (i.e., two axes, two components) to explore the relationships between them. (see appendix)

As the categories are far from the origin, this means that they are highly associated and vice versa.

**Figure 3:** MCA plot of categories SOL-Q



Based on MCA principle (see appendix) the plot was divided into four quadrants.

### Interpretation of MCA Plot

The four categories “high metacognitive skills”, “high time management”, “high persistence”, and “moderate metacognitive” skills located in the right bottom quadrant of the plot and form a cluster. These categories are closely located, indicating strong similarity. Thus, it’s likely that students who had “high metacognitive skills” most frequently had also “high time management” and “high persistence” and “moderate or high metacognitive skills” in self-learning.

On the top right quadrant of the plot there were only two similar categories “moderate persistence” and “moderate management”. They were well represented, far from origin, close together, and had the same direction from origin. “moderate persistence” was very far from origin which means it’s more distinctive. The most probably that the student who had “moderate persistence” also had “moderate management”.

On the left bottom quadrant of the plot, there were three similar categories, “low help seeking”, “moderate help seeking”, and “low environmental structuring”. They were well represented, far away from the origin, close together, and had same direction from origin. Thus, the most often of the students who had low (16/17) or moderate (7/7) seeking help also had low environmental structuring. This region reflects students with limited help-seeking behavior and environmental support.

Moreover, since based on the interpretation of MCA plot we realized that metacognition and persistence (which had low scores) were highly associated; by return high scores of helps seeking guide reflects the inability for the students to be self-independent learners; accordingly, we decided to figure out if there exist causal relationship among such three categories; thus, we go for path analysis. In other words we wanted to know if the inability to be self-independent learner reflected by high scores of help seeking is controlled by persistence or metacognitive skills or both.

### 3.3 Multivariate Analysis (Based on JASP software)

The aim of this analysis is to study the effect of students’ gender and educational level on their self-regulated online learning scores.

#### 3.3.1 Student’ gender

One-way MANOVA (using JASP software) was used to check the effect of gender (Female, Male) on SOL-Q factors. The question is: Do gender (Female, Male) affect students ‘scores in metacognitive skills, time management, environmental structuring, persistence, and help seeking?

**Table 3:** MANOVA (Pillai’s Trace Test)

| Cases  | Df | Approx F | Trace <sub>Pillai</sub> | Num df | p     |
|--------|----|----------|-------------------------|--------|-------|
| Gender | 1  | 0.462    | 0.023                   | 5      | 0.804 |

Table 3 showed the results of one way MANOVA analysis. The value of Pillai’s Trace is 0.023, this is very close to 0, which means the scores of females and males students are very similar in SOL-Q. About 2.3 % of the variance in the combined variables is explained by the student’ gender. The results showed no statistically significant multivariate effect of gender,  $F(5, 98) = 0.462$ ,  $p = .804$ . Thus, the null hypothesis cannot be rejected. This suggests that student’s gender does not have a statistically significant effect on the combined dependent variables. In

other words, there is no difference in metacognitive skills, time management, environmental structuring, persistence, and help seeking scores between females and male's students

### 3.3.2 Student's educational level

A PERMANOVA test (using python software) was used to detect whether there were significant multivariate differences in metacognitive skills, time management, environmental structuring, persistence, and help-seeking scores based on student' educational level. PERMANOVA used since the assumptions of Pillai's Trace Test in one-way MANOVA didn't verify. The null hypothesis ( $H_0$ ) of PERMANOVA is that the average vectors of metacognitive skills, time management, environmental structuring, persistence, and help seeking are equal for all educational levels.

The analysis revealed that no statistically significant difference in SOL-Q factors scores among students according to their educational level  $F(4,99) = 0.003$ ,  $p = .0305$ .

**Table 4:** PERMANOVA test

| Method name | Statistic F | p-value | Permutations |
|-------------|-------------|---------|--------------|
| PERMANOVA   | 0.003       | 0.3053  | 999          |

Thus, the educational level of the student did not affect the self-regulated online learning level (low, moderate, high).

## 4 Discussion

Concerning research question 1: Till which extinct are university students ready toward the self-regulated online learning, in terms of its five aspects (metacognitive skills, time management, environmental structuring, persistence and help seeking)?

Results showed that the students are not ready toward self-regulated online learning in terms of 3 aspects (that represent 28 items out of 36 items of the SOL-Q) out of the 5 aspects; Thus, we can conclude that university students in Beirut are not ready toward self-regulated online learning; this matches with the study of (Lim and Yeo, 2021), that students with low persistence can be considered ready toward SRL since they lack their intrinsic motivation. ready in terms of help seeking; which matches with (Bandalos et al., 2003), who mentioned that giving students advice on learning

strategies might enhance their academic performance and self-control. Moreover, the results of right bottom quadrant MCA plot showed that high metacognitive skills, high time management, and high persistence are highly associated; this is doesn't agree totally with (Su et al., 2018), who mentioned that time management and metacognitive skills are associated but with environmental structuring instead of persistence.

Concerning research question 2: the results of ONE-WAY MANOVA suggests that student's gender does not have a statistically significant effect on the combined dependent variables. In other words, there is no difference in metacognitive skills, time management, environmental structuring, persistence, and help seeking scores between females and male's students; However, our results don't match with the results of the study of Liu et al. (2021), that showed that in every phase—preparatory, performance, and appraisal—females demonstrated greater self-regulation than males.

Concerning research question 3: The results of PER-MANOVA revealed that no statistically significant difference in SOL-Q factors scores among students according to their educational level  $F(4,99) = 0.003$ ,  $p = 0.305$ . This result fill the gap in the literature; since it wasn't examined before in any study.

## Conclusion

This research underscores how limited metacognitive development can act as a barrier to the effective implementation of research findings in educational decision-making. Consequently, the study proposes actionable strategies to overcome these barriers, including:

- Integrating metacognitive training into university learning systems,
- Promoting interdisciplinary research to bridge the gap between researchers and policy-makers,
- Strengthening collaboration between universities, research centers, and policy-makers,
- Invest in artificial intelligence and digital technologies to tailor evidence-based educational interventions.



Self-regulated learning must be incorporated into educational frameworks in order to shape policies that support equitable and sustainable teaching and learning systems, since the demand for online learning keeps rising. We can help achieve the larger objective of developing robust, forward-thinking educational institutions that encourage lifelong learning for everyone by giving students the tools they need to succeed in online settings

SROL as a diagnostic tool for education system readiness. Metacognitive skills as leverage points for policy change. Till which extinct are we able to provide quality education that meets the needs of our learners to become highly self-regulated during online learning?

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## Appendices

### Appendix A: Appendix A: Self-regulated online learning questionnaire (SOL-Q)

#### Metacognitive skills

1. I think about what I really need to learn before I begin a task in this online course.
2. I ask myself questions about what I am to study before I begin to learn for this online course.
3. I set short-term (daily or weekly) goals as well as long-term goals (monthly or for the whole online course).
4. I set goals to help me manage my studying time for this online course.
5. I set specific goals before I begin a task in this online course.
6. I think of alternative ways to solve a problem and choose the best one for this online course .
7. I try to use strategies in this online course that have worked in the past.
8. I have a specific purpose for each strategy I use in this online course.
9. I am aware of what strategies I use when I study for this online course.
10. Although we don't have to attend daily classes, I still try to distribute my studying time for this online course evenly across days.
11. I periodically review to help me understand important relationships in this online course.
12. I find myself pausing regularly to check my comprehension of this online course.
13. I ask myself questions about how well I am doing while learning something in this online course.
14. I think about what I have learned after I finish working on this online course.
15. I ask myself how well I accomplished my goals once I'm finished working on this online course.
16. I change strategies when I do not make progress while learning for this online course.
17. I find myself analyzing the usefulness of strategies while I study for this online course.
18. I ask myself if there were other ways to do things after I finish learning for this online.

#### Time management

19. I find it hard to stick to a study schedule for this online course.
20. I make sure I keep up with the weekly readings and assignments for this online course.

21. I often find that I don't spend very much time on this online course because of other activities.

#### **Environmental structuring**

22. I choose the location where I study for this online course to avoid too much distraction.

23. I find a comfortable place to study for this online course.

24. I know where I can study most efficiently for this online course.

25. I have a regular place set aside for studying for this online course.

26. I know what the instructor expects me to learn in this online course.

#### **Persistence**

27. When I am feeling bored studying for this online course, I force myself to pay attention.

28. When my mind begins to wander during a learning session for this online course, I make a special effort to keep concentrating.

29. When I begin to lose interest for this online course, I push myself even further.

30. I work hard to do well in this online course even if I don't like what I have to do.

31. Even when materials in this online course are dull and uninteresting, I manage to keep working until I finish.

#### **Help seeking**

32. When I do not fully understand something, I ask other course members in this online course for ideas.

33. I share my problems with my classmates in this course online so we know what we are struggling with and how to solve our problems.

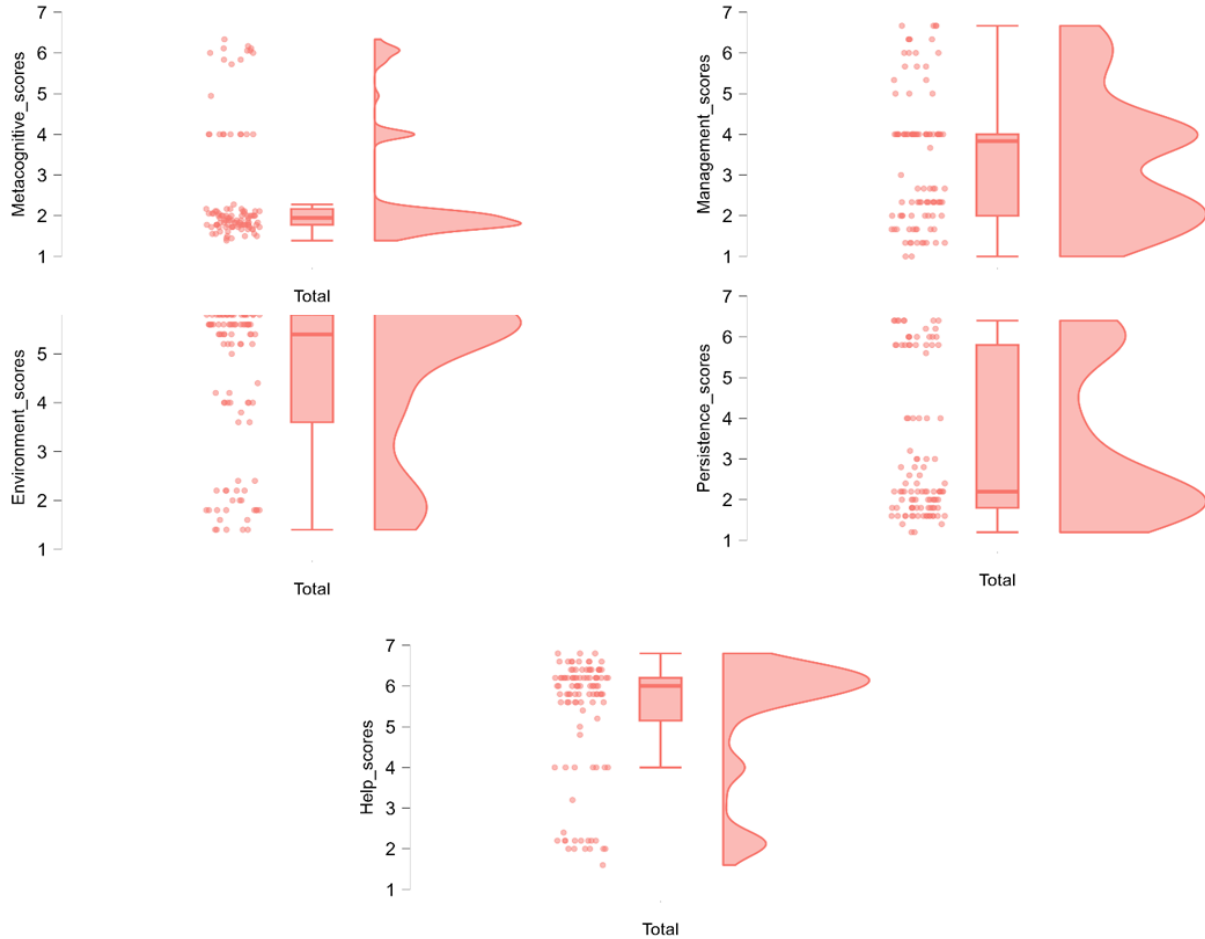
34. I am persistent in getting help from the instructor of this online course.

35. When I am not sure about some material in this online course, I check with other people.

36. I communicate with my classmates to find out how I am doing in this online course.

Items are answered on a 7-point Likert scale, ranging from "not at all true for me" (= 1) to "very true for me" (= 7). All items are presented in randomized order.

## Appendix B: Distribution of Self-regulated online learning questionnaire strategies (factors)



## Appendix C Description of interpretation of MCA plot formation

In MCA plot, the interpretation of the spatial relationships between categories is central to understand the similarities and associations between them. Proximity between categories means statistical similarity in the overall pattern of response profiles. Two categories close on MCA plot means they co-occur. In other words, they are associated or frequently selected together by the same group of students across the strategies (e.g., if two categories A and B are close means students who pick category A often also pick category B).

Also, the distance between the origin and the category is very important, the categories close to the origin are average in their profile and less informative, while the categories lies far from origin considered distinctive (absolute distance  $\geq 0.5$ ).

The direction from the origin to the category also matter. Categories that lie in the same direction (vector) from the origin tend to show a shared behavioral or profile trend, even if their distances from the origin are different.

During the analysis, MCA plot divided into four quadrants, only the well represented categories ( $\cos^2 \geq 0.5$ ), far from origin (absolute distance  $\geq 0.5$ ), have the same direction from origin, and close together are interpreted.

Several metrics used in analyzing MCA plot. The squared cosine ( $\cos^2$ ) is the most important indicator to determine which categories are **trustworthy on the plot**. A category with a squared cosine greater than or equal to 0.5 ( $\cos^2 \geq 0.5$ ) considered well represented (Greenacre, 2007).

## Appendix D: Description of the Interpretation of the MCA Plot

In multiple correspondence analysis the inertia of the component represents the information accounted for by this component, the importance of an axis increases as the inertia value increases. Inertia values in MCA are low due to the high number of variables and categories, a 30–40% cumulative inertia in a two-dimensional plot is generally sufficient for interpretation (Greencare ,2007).

In this study, the multiple correspondence analysis produced ten axes (the difference between the total number of categories and the total number of variables = 15-5). The first and the second components explained respectively 33.84% and 18.76 % of the total inertia(variance). The cumulative inertia is 52.6% of the total inertia considered a strong representation of the categories in two dimensions (Figure 2).

Among the fifteen categories four of them cannot interpreted since they are not well represented ( $\cos^2 < 0.5$ ) or they are near from origin, these categories are less informative.

## Appendix E: Interpretation of similarity between categories in MCA plot

| Situation of well represented categories | Interpretation   |
|--|--|
| Close distance & same direction          | Strong similarity (high co-occurrence, shared profile) |
| Same direction, different distance       | Similar behavior but different intensity               |
| Close but different direction            | Not necessarily similar — could be misleading          |

Squared cosine and distance from origin of categories on MCA plot

|    | Category               | Total Squared | Distance from |
|----|------------------------|---------------|---------------|
| 1  | High Metacognition     | 0.554         | 1.99          |
| 2  | Low Metacognition      | 0.993         | 0.48          |
| 3  | Moderate Metacognition | 0.298         | 1.62          |
| 4  | High Management        | 0.991         | 1.91          |
| 5  | Low Management         | 0.923         | 0.88          |
| 6  | Moderate Management    | 0.86          | 1.16          |
| 7  | High Environment       | 0.941         | 0.64          |
| 8  | Low Environment        | 0.836         | 1.57          |
| 9  | Moderate Environment   | 0.116         | 0.78          |
| 10 | High Persistence       | 0.992         | 1.54          |
| 11 | Low Persistence        | 0.912         | 0.59          |
| 12 | Moderate Persistence   | 0.524         | 2.21          |
| 13 | High Help              | 0.859         | 0.48          |
| 14 | Low Help               | 0.922         | 1.59          |
| 15 | Moderate Help          | 0.642         | 1.66          |

Contingency table of metacognitive skills and persistence

|             |          | Metacognitive skills |          |      | Total |
|-------------|----------|----------------------|----------|------|-------|
|             |          | Low                  | Moderate | High |       |
| Persistence | Low      | 70                   | 0        | 0    | 70    |
|             | Moderate | 6                    | 0        | 0    | 6     |
|             | High     | 6                    | 10       | 12   | 28    |
| Total       |          | 82                   | 10       | 12   | 104   |

Contingency table of metacognitive skills and time management

|                 |          | Metacognitive skills |          |      | Total |
|-----------------|----------|----------------------|----------|------|-------|
|                 |          | Low                  | Moderate | High |       |
| Time Management | Low      | 51                   | 0        | 0    | 51    |
|                 | Moderate | 29                   | 3        | 1    | 33    |
|                 | High     | 2                    | 7        | 11   | 20    |
| Total           |          | 82                   | 10       | 12   | 104   |

Contingency table of help seeking and environmental structuring

|             |          | Help Seeking |          |      | Total |
|-------------|----------|--------------|----------|------|-------|
|             |          | Low          | Moderate | High |       |
|             | Low      | 16           | 7        | 2    | 25    |
|             | Moderate | 1            | 0        | 12   | 13    |
|             |          |              |          |      |       |
| Environment | High     | 0            | 0        | 66   | 66    |
| Total       |          | 17           | 7        | 80   | 104   |

## Appendix F: Principle of One Way MANOVA

One-way MANOVA uses Pillai's Trace Test to detect whether there is a significant difference in students' scores across females and male's groups. The null hypothesis( $H_0$ ) of Pillai's Trace Test is that the average vectors of metacognitive skills, time management, environmental structuring, persistence, and help seeking are equal for females and males students.

The value of Pillai's Trace ranges between 0 and 1. It measures the proportion of variance explained by the model. It's recommended when Assumptions are violated (e.g., normality). A value of zero means the groups averages are similar (i.e. weak or no effect of gender), while a value of one means the groups averages are different (i.e. strong effect of gender). Thus higher value of Pillai's Trace means greater groups differences.