

TMBQ-LT: A Student-Facing Learning Tool to Support Time Management Skills

Ana-Gabriela Núñez¹^a, Vanessa Echeverría^{2,3}^b, Miguel Zuñiga-Prieto¹^c, Benito Auria²
and Tinne De Laet⁴^d

¹*Department of Computer Science, Universidad de Cuenca, Cuenca, Ecuador*

²*Escuela Superior Politécnica del Litoral, ESPOL,
Centro de Tecnologías de Información, Guayaquil, Ecuador*

³*Monash University, Clayton, VIC, Australia*

⁴*Faculty of Engineering Science Engineering and Science Education Center, KU Leuven, Leuven, Belgium*

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Abstract: To be successful in Higher Education, students must acquire good self-regulation and learning skills. Past studies have reported that undergraduate students are overconfident in recognizing their self-regulatory strategies. This overconfidence can be detrimental during the first years of their undergraduate program if they are not properly nurtured. The lack of students' motivation, self-regulation and time management strategies can lead to higher rates of drop-out. In this sense, student-facing learning tools can provide timely feedback to support awareness, strengthen this self-regulation and time management skills, and thus be instrumental for students in attaining their learning goals. In this paper, we present the TMBQ-LT, a student-facing tool that consists of 1) a set of questions derived from the Time Management Behavior Questionnaire (TMBQ), 2) a visualization showing student's time management (TM) predispositions and 3) tailored recommendations based on students' self-reported TM skills. This paper illustrates a case study on the deployment of the TMBQ - LT by students from three HE institutions and provides recommendations for future implementations and adoption of the tool.


1 INTRODUCTION


To succeed in Higher Education, students must acquire good self-regulation and learning skills. Past studies have reported that undergraduate students are overconfident in recognizing their self-regulatory strategies (Zimmerman, 2008) when they have not acquired a specific skill (Kruger and Dunning, 1999). This overconfidence in their self-regulation strategies can be detrimental during the first years of their undergraduate program if they are not properly nurtured. Current research points out that student's lack of motivation, commitment, and self-regulation skills may increase the risk of drop-out and dissatisfaction with the learning experience (Heikkilä and Lonka, 2006),


which has been exacerbated by the COVID-19 (Hamdan et al., 2021).


Self-Regulated Learning (SRL) refers to the cognitive, metacognitive, and motivational factors that students use to attain and accomplish their goals during the learning processes (Zimmerman, 2000). Research has found that SRL strategies, such as goal setting, strategic planning, and time management, are associated with students' performance and attainment of goals (c.f., (Kizilcec et al., 2017)). Therefore, HE institutions should provide counseling strategies to foster students' SRL skills, aiming at improving their academic performance and learning experience (Heikkilä and Lonka, 2006). In this work, we are interested in fostering time management skills, an SRL sub-construct.

Nurturing students' time management skills is time-consuming for different HE stakeholders (i.e., teachers, advisors, and counselors). As students possess different learning competencies, it is hard to

^a  <https://orcid.org/0000-0002-4996-0390>

^b  <https://orcid.org/0000-0002-2022-9588>

^c  <https://orcid.org/0000-0001-9369-1813>

^d  <https://orcid.org/0000-0003-0624-3305>

develop a one-size-fits-all strategy (Gašević et al., 2016). Learning Analytics (LA) tools may provide a solution to address the challenge of delivering timely and tailored feedback at scale (Pardo et al., 2019), aiming at raising students' awareness about their regulation strategies and triggering reflection about their learning and performance.

According to Winne and Perry (2000), SRL can be distinguished at *component-oriented* and *process-oriented* levels. The *component-oriented* level is defined as students' attributes or predispositions for learning, regardless of the learning environment in which they occur. In contrast, The *process-oriented level* is focused on the coordination, control and regulation of strategies during the learning process. In a recent literature review (Núñez et al., 2022), the authors reported that SRL tools often support time management strategies at the process-oriented level, for instance, by displaying the time spent when students interact with a learning platform (e.g. (Pérez-Álvarez et al., 2017)) or by supporting the scheduling and organization of activities (e.g., (Alario-Hoyos et al., 2015)). However, to our knowledge, SRL tools that support time management at a component-oriented level are limited. This work aims to contribute to these under-explored tools to support time management skills. To this end, we designed and deployed the TMBQ-LT, a student-facing learning analytics tool to allow students to 1) assess their time management skills by filling the Time Management Behavior Questionnaire (TMBQ); 2) visualize their time management predispositions; 3) get tailored feedback based on their levels of time management predispositions.

2 RELATED WORK

In Learning Analytics (LA) and Educational Technology (EdTech) research, there have been many initiatives to support the development of such time management skills. For instance, most of the research have used log data from digital learning environments, such as Learning Management Systems (LMS). In the literature review by Perez-Alvarez et al. (Pérez-Álvarez et al., 2018), the authors reported a list of EdTech tools that support SRL in online environments, such as MOOCs. The most prominent tools were the data coming from online student activity in the LMS (e.g., days and number of logins to the LMS, the number of views on weekly course videos and e-books, the frequency of participation in the forum environment (Karaoglan Yilmaz and Yilmaz, 2020)), and assessment data (assessment

scores on weekly assignments or quizzes or knowledge levels obtained from such assessments (García-Solórzano et al., 2018)). Another source of data was self-reported data through the LMS (e.g., self-set goals and surveys to measure students' perceptions or overall experience or beliefs) (Aguilar et al., 2021; Inan-Karagul and Seker, 2021; Karaoglan Yilmaz and Yilmaz, 2020). In addition, self-reported survey data from students has only been studied to understand their beliefs and current motivations about SRL when moving from high school to a higher education institution (García-Ros and Pérez-González, 2012). Nonetheless, the results from questionnaires are often used for research purposes, for example, to understand the impact of time behavior skills on academic performance (e.g., (Adams and Blair, 2019)), meaning that students often do not receive their results as feedback for improvement.

Another strand of literature indicates that feedback on SRL is most often presented through LA dashboards, due to its potential benefits for students success or learning outcomes (Viberg et al., 2020; Matcha et al., 2019). Viberg and colleagues (Viberg et al., 2020) presented a review of empirical research on LA and self-regulation for online learning environment, highlighting the potential of digital traces to measure SRL strategies. For instance, PeerLA (Konert et al., 2016) allows students to keep track of their knowledge level (self-report data) and compare this information with automatically extracted measures collected from Moodle through visualisations. In another work, authors presented LASSI (Broos et al., 2017), a dashboard that presents feedback to first-year university students about their personal skills (concentration, failure anxiety, motivation, use of test strategies, and time management). Students also receive recommendations on how a particular skill can be improved. LASSI has been widely applied in European Universities, and empirical evaluation demonstrated its positive impact on scalability, usefulness and usability. Inspired by this latter research, we applied a similar approach in a Latin American context. Nevertheless, we are interested in a deeper analysis of time management dimensions instead of analyzing it as a unique skill.

3 TMBQ-LT: AN LA TOOL TO SUPPORT TIME MANAGEMENT

The TMBQ-LT tool has been developed as a web application. The tool provides Higher-Education stu-

dents with tailored feedback on time management strategies according to their current time management skills levels.

3.1 Assessment of Student’s Time Management Skills

To assess students’ time management skills or pre-dispositions levels, we use the Time Management Behavior Questionnaire (TMBQ) self-report questionnaire, which has been previously validated with college students (García-Ros and Pérez-González, 2012). The TMBQ consists of 34 statements distributed in four dimensions: *establishing objectives and priorities* (D1), *use of time management tools* (D2), *preferences for organization* (D3), and *perception of control over time* (D4). Thus, TMBQ-LT provides tailored recommendations for each dimension. The statements can be answered using a five-point Likert scale (1: never, 5: always). To assess students’ time management skills, we assign the score given by a student in the Likert scale, meaning that each statement could have a minimum score of 1 if the student selects “never” and a maximum score of 5 if the student selects “always.” After, we calculate a *total score* by summing up all scores from the 34 statements and a *score per dimension* by summing up the scores from the statements per dimension. To facilitate the interpretation of results, these scores are scaled to 100. Thus, we will have five scores per student: the total and D1 to D4 scores, ranging from 0-100.

Following a similar approach as in well-known academic tests (e.g., TOEFL iBT, GRE), we assigned a skill level per dimension. Each dimension has five levels, so when a score falls within a range level, it will assign that level to the specific dimension. Table 1 summarizes the dimensions and their corresponding labels and value ranges.

Table 1: Scores boundaries for skill levels.

	low	medium	medium-high	high
D1	[10,30)	[30,35)	[35,40)	[40,50]
D2	[11,25)	[25,32)	[32,39)	[39,55]
D3	[8,14)	14	[15,17)	[17,25]
D4	[12,24)	[24,28)	[28,31)	[31,40]

To account for the variability and context of our population, these ranges were calculated using a sample (N=1083) of students that completed the TMBQ. We processed the dataset from the TMBQ to calculate quartiles and their boundaries per dimension. The participants obtained a score between the lowest and highest boundary in each dimension, e.g. regarding D1: If students obtained scores between [10,30), it

means that those students have low skills in establishing objectives and priorities. On the other hand, if students got scores between [40,50), it means that they have high skills in D1.

3.2 Visualization Components and Tailored Feedback

The feedback tool is composed of A) the total score, B) a polar area diagram to display four quadrants - one per dimension - with its corresponding score (see Figure 1, and C) a set of recommendations based on their levels of personal skills (for example, see Figure 2).

As depicted in Figure 1, each quadrant is color-coded to support the interpretation of the score. The color represents one of the four levels in which a student can be allocated: high (green), medium-high (light green), medium (yellow) and low (orange). The diagram also portrays a red line, representing the average score from students with a similar profile (i.e., age), allowing students to compare their score to other learners and improve their motivation, as suggested in (Wise, 2014).

Below each dimension’s name, a student can click the link “*See recommendation*”, which opens a window showing advice tailored to the score and level obtained (Figure 2). These recommendations were co-constructed with two advisors from Institution 1. Each advisor was invited to participate in a semi-structured interview to examine the recommendations experts would give students to improve time management skills. In the interview, led by one researcher, the advisor was asked to propose three tips that students can easily follow and three digital tools to help them manage their time. After these interviews, the researcher crafted a final list of tips and tools, which the two advisors further verified and agreed upon.

4 EXPLORATORY STUDY

The main goal of this exploratory study was to introduce the TMBQ-LT to students from different HE institutions and explore their perceptions of the tool’s usage and potential impact. Therefore, we aim to:

1. Explore the current situation of students’ time management strategies.
2. Understand students’ perceptions of the score satisfaction, usefulness, and information clarity.

Figure 3 depicts the deployment of our study taking a learning analytics process (Clow, 2012). Our study is mainly focused on students enrolled in HE

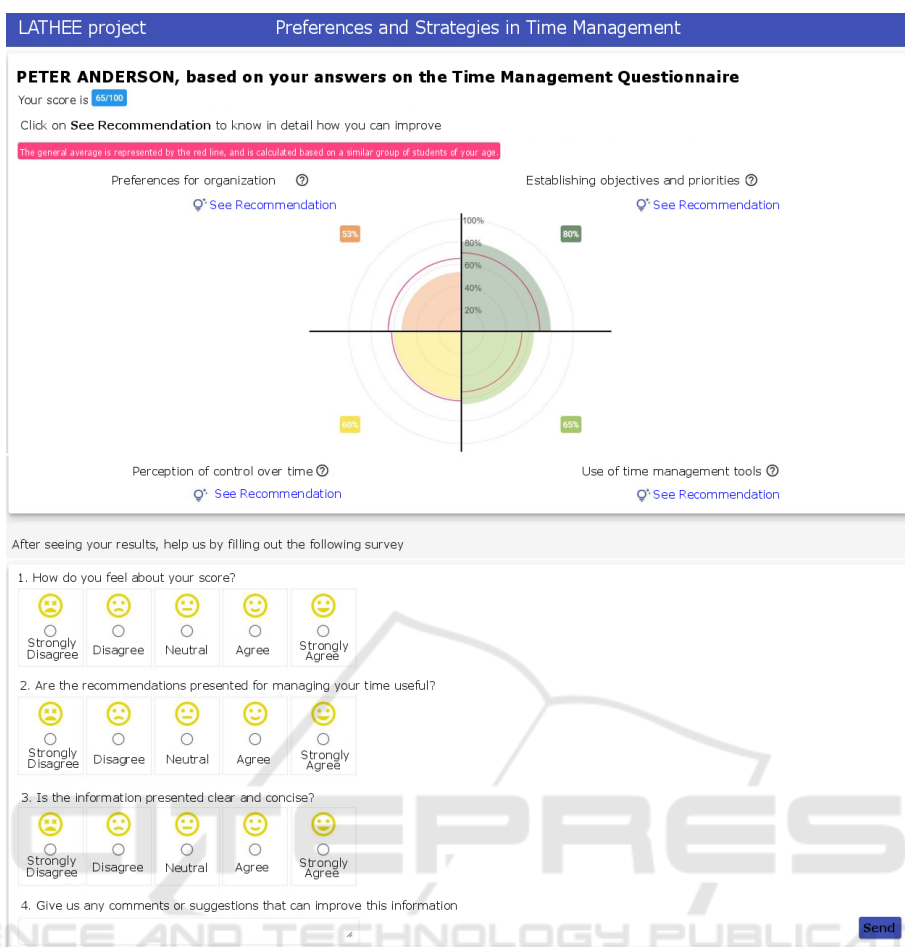


Figure 1: Overall score and LA visualization depicting scores per each dimension. The red line represents the average score of students with a similar profile (i.e., age).

institutions. We collected self-reports from these students using the TMBQ. We used statistical analysis, as explained in section 3.1, to generate visualizations and recommendations tailored to students’ time management skill levels. Finally, we aim to provide recommendations and support the reflection of their current skills.

The following sections describe the methods and analysis to address the two goals of this exploratory study.

4.1 Participants, Tasks and Data Collection

Three HE institutions participated in this study; in partnership with their academic and counselling services, we invited students to participate in the webinar “Techniques to Manage Time” (executed four times) and in a workshop, hereafter referred to as dissemination sessions. We used different HE institutions’

official social media channels (i.e., Facebook, Twitter, Instagram), and email to invite students. Dissemination sessions were programmed online via zoom between June and July 2022. During the execution of the dissemination sessions, an expert presented several strategies to learn and improve time management and invited students to use the TMBQ-LT tool. Students filled out the TMBQ questionnaire including demographic questions (i.e., age, gender), obtaining the tailored feedback and recommendations generated by the tool. In order to measure the usefulness and students’ satisfaction with the tool, students filled out a questionnaire. This questionnaire includes three five-point Likert-scale questions (Q1-score satisfaction: “How do you feel about your scores?”; Q2-usefulness: “Are the recommendations and scores useful?”; Q3-clarity: “The visualization and recommendations are clear and concise?”) and one open-ended question (“Tell us more about your perception of the tool and suggestion for improvement”).

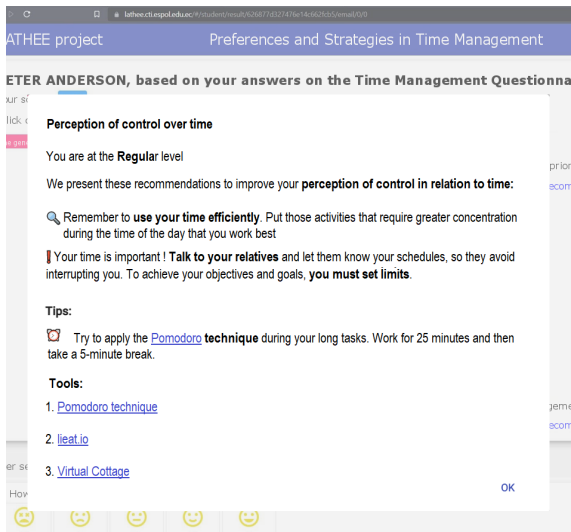


Figure 2: An example of the recommendations given to students. This is an example for a student who clicked on the recommendations for D2 and got a medium skill level.

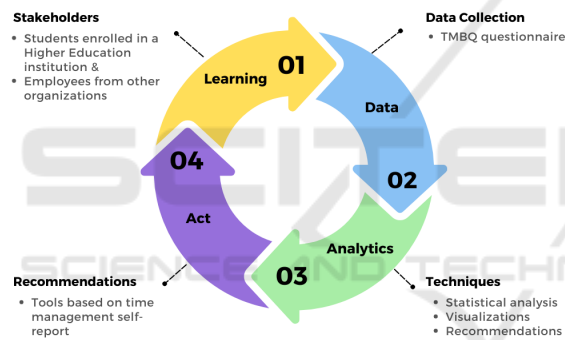


Figure 3: Our study taking a learning analytics process.

4.2 Results

A total of 1083 students completed the TMBQ. Table 2 shows the distribution of students who completed the TMBQ according to their gender. Table 3 summarizes the age of students per institution.

First, to explore the current situation of students' time management strategies, we analyzed the results from the TMBQ questionnaire per institution and per dimension. Figure 4 depicts the results per institution. From these results, we can observe that, for D1 (establishing objectives and priorities), most students have

Table 2: Distribution of students per institution.

	I1	I2	I3	Total
Female	224	125	42	391
Male	344	231	113	688
Prefer not to say	1	2	1	4
Total	569	358	156	1083

Table 3: Students' age descriptive statistics per institution.

	I1	I2	I3
min age	17	17	17
max age	42	51	30
average	19.64	21.40	20.67
std dev	2.34	3.81	2.51

a medium-high level for this dimension, independent of the institution. As for D2 (use of time management tools), most students exhibited a medium (I2) or medium-high level (I1 and I3). In D3 (preferences of organization), most students reported a medium level (I1, I2 and I3). Finally, for D4 (perception of control over time), students exhibited a medium-high level.

Second, to understand students' perception of the usefulness of the feedback tool, we calculated descriptive statistics for the three Likert-scale questions, as shown in Table 4. 662 out of 1083 students evaluated their perceptions of the tool. From Table 4, we can observe positive results reported by students about the usefulness (Q2) and clarity (Q3) of the tool. Nevertheless, students were not completely satisfied with their scores (I1 - M:3.39, SD: 0.69; I2 - M:3.88, SD: 0.77; I3 - M:3.40, SD: 0.75).

Table 4: Students' perceptions about (Q1) score satisfaction, (Q2) usefulness and (Q3) clarity.

	I1 M(SD)	I2 M(SD)	I3 M(SD)
Q1	3.69 (0.69)	3.88 (0.77)	3.40 (0.75)
Q2	4.17 (0.69)	4.18 (0.85)	3.89 (0.85)
Q3	4.24 (0.73)	4.32 (0.78)	3.92 (0.82)

Additionally, we conducted a thematic analysis (Clarke et al., 2015) of the qualitative data from open-ended questions. Two researchers analyzed the quotes and got a consensus after interpretation discussions. A total of 164 quotes extracted from students' responses were thematically coded into 1) Positive, 2) Negative, 3) suggestions for improvement, and 4) reflective comments.

Regarding **positive comments**, 47% of students gave positive comments about the feedback presented in the tool. They think that the tools recommended help meet their goals. One student mentioned that: "the tools suggested will help us to improve our time management strategies" (S32, I2) and another student shared that: "the information will help us to know the way to meet our goals" (S34, I2). Students also think that the tool is consistent, and the visualization helps them reflect on their weaknesses and ways to improve their organization. For instance, P54 (I2) mentioned that "The questionnaire is consistent with the visualization so that we can self-assess our daily

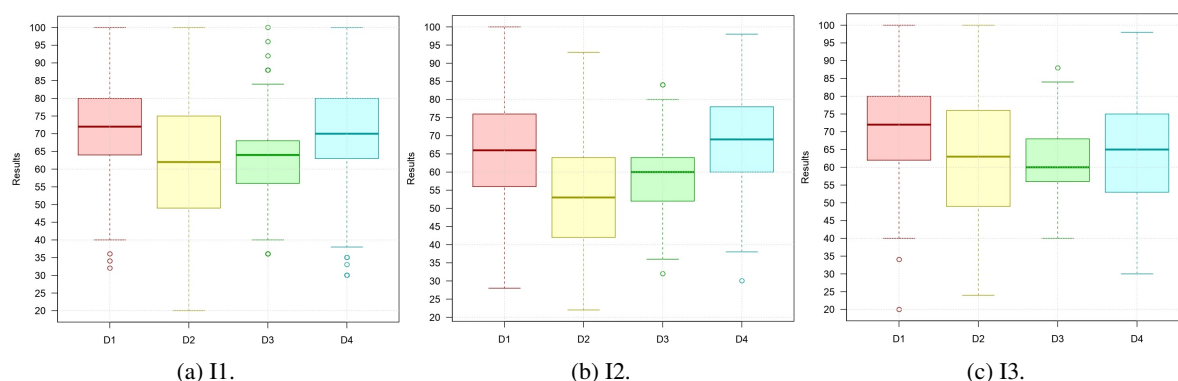


Figure 4: TMBQ results per institution.

performance”. Supporting this idea, P116 (I1) expressed that “the tool is a perfect way to know the weak points when organizing my day.” And, P46 (I2) reflected on the usefulness and future use as follows: “The diagram presented in at the end [visualization] was handy, because it allows me to see my general performance, what I should improve, and what tools I can use to help me organize my time and academic activities. If I retake this questionnaire, I will be able to reflect on my past and be more organized”. In addition to the positive comments about the tool, students also liked these dissemination sessions and feedback initiatives. One student mentioned that “the university should provide students ways to improve our time management to achieve our goals” (S44, I2) and another expressed that “I hope they [university] continue to carry out more dissemination sessions with this topic” (S42, I2)

Regarding **negative comments**, 4% of students gave negative comments about the tool. Some students requested to make the information clearer and more concise. For example, one student expressed that “a more specific explanation could be added” (P86, I1). Improvements in multi-platform mobile devices were also raised. As one student expressed: “The mobile version had some complications and issues, such as the legibility of the information. Therefore, different devices should be considered in a further version” (P33, I2).

Regarding **suggestions for improvement**, 20% of students provided suggestions concerning the dissemination session content, the information gathered from the questionnaire, and the information presented in the recommendations. Students suggested that more real-world examples should be included in the dissemination sessions (P5, P23-I1; P115-I3).

Concerning the questionnaire, students mentioned that the questionnaire should include questions that reflect real-life examples to capture their reality creatively (P12-I1; P115-I3). For example, one student

expressed that “there should be a section to ask if you dedicate more time to social activities compared to other activities” (P105, I1); similar to what was indicated by P124 (I1): “There should be questions about the relationship between your time for study and the time you dedicate to your friends and family.” In addition, one student suggested that the self-report should include questions about the use of digital tools, as the current TMBQ only focuses on general tools such as agendas: “I think you could add a question to ask if you use a digital tool for time management. Personally, I don’t use agendas, but I prefer to use an app installed in my phone to manage my time and habits” (P81, I1). P149 (I1) commented, “You should consider that not all students are used to carrying out an agenda.” Another student suggested adding questions about willingness, motivation, and engagement (P25, I3). In contrast, another student suggested adding “open-ended questions” to explain their situation (P74, I1).

Concerning the feedback information (i.e., the visualization and recommendations), students suggested that it would be beneficial for them to add other topics to the recommendations: “I would add more recommendations to improve my time management skills” (P115-I3, P142-I1.) For example, students would like to receive a study plan for short and long-term goals: “I would like to receive a study plan for my short and long-term goals” (P95, I1). Another student suggested including learning strategies: “You could also add learning strategies and not only focus your recommendations on tools like Pomodoro” (P125, I1). One student recommended adding more details and context about their flaws (P30, I1).

Regarding the recommendations of digital tools, students mentioned that other tools should be considered for this matter. One student expressed that, while “Pomodoro” can work well for some students, he would prefer other tools that do not interrupt while working: “I don’t like Pomodoro because it limits

your time and sometimes the alarm goes on when you have increased your motivation to work" (P40, I2). Other tools could be included as part of the list of recommendations, such as "Forrest," which allows keeping your study times using gamification elements. Other students mentioned that the recommendations should also factor in external aspects that could affect their time management strategies: *"The tool should also focus on external factors that could affect their organization. It is not only a matter of assuming that a student is lacking commitment for an organization"* (P68, I1). Finally, concerning **reflective comments**, 3% of students reflected on their results, even though this was not asked. Students were mostly surprised by these results. One student mentioned, *"I was somewhat surprised, I know that I don't use 100% of my energy at work, but I didn't know it was low"* (P17, I3). Another student expressed: *"To be honest, I didn't know I have to improve a lot"* (P133, I1). Another student reflected on the misalignment between his self-reflection and results displayed in the tool: *"I have very important goals and objectives for myself and to improve this society. Maybe I gave lower scores to questions regarding this topic. Hence, I got lower results"* (P78, I1).

5 DISCUSSION

This work aimed to address two goals. The first goal was to explore the current situation of student time management strategies in a Latin American context. Using the TMBQ embedded in the tool, we extracted the survey results from first-year students enrolled in three local HE institutions. While the results reflect students' positive perception of their time management skills, some reported a medium to high-medium skill level in using time management tools (D2). The TMBQ-LA tool gave students recommendations about digital tools that they could use to improve this skill. Although these results suggested that students' time management strategies are acceptable, it is worth mentioning that this subjective data should also be supported by more objective data, such as digital traces from learning environments. In this way, the tool could give better insights, as it is well known that young students exhibit errors when systematically self-reporting data. Hence it could hinder the validity of results (Colladon and Grippa, 2018). In addition, while we reported the TMBQ survey results, our intention was not to explore the differences between students enrolled in different institutions. Instead, we aimed to test the current status of our students and how we can best support them.

The second goal was to explore students' perceptions of the tool in terms of score satisfaction, usefulness, and clarity. Our results suggest that, overall, students perceived the tool as helpful, and the information presented was clear and concise. This was reflected in students' positive comments about the tool. On the contrary, students reported a neutral position regarding their satisfaction with their results and feedback. Two main points could explain this. First, as mentioned above, students' self-report data is prone to unconscious errors, which may cause a disconnection between their beliefs and the actual score they reported. Second, students' comments pointed out that the questionnaire should factor in external situations, such as social, economic and life-related factors. In our local context, students often face uncertainty in several social planes, which may cause disruptions in their learning and performance. Another social factor that affects current young students is procrastination. Students suggested that more information about learning strategies or study plans would be beneficial to (at least try to) overcome these diverse challenges. Students also valued this initiative, as it is not a common practice for students to receive this type of feedback or recommendations. In our country, LA solutions are scarce. Hence this work is one of the first initiatives to build the infrastructure needed to implement a LA solution at scale.

6 CONCLUSION

This work presented the TMBQ-LT, a LA feedback tool to measure the time management predisposition of students and provide tailored feedback based on their skill levels. This tool is one of the first being deployed in our local context. Results revealed a student's positive attitude towards the tool's usefulness and the clarity of the information. Future work should address more longitudinal studies to measure the tool's impact. It should also include follow-up interventions to support more reflective practices.

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