Examining university students' motivation, abilities and preferences related to learning to learn

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Abstract—**Learning to learn has been identified as an underdeveloped yet critical skill for learners. However, interventions often struggle to alter learner behavior in a lasting manner. We conducted a quasi-experimental study, guided by the Fogg Behavior Model, that involved 83 first-year university students in a computer engineering degree program. Our study examined learner levels of motivation, self-assessments of their abilities, and preferences for future interventions related to learning to learn. Our results suggest that student learning to learn skills are underdeveloped, not all students are motivated to improve their learning skills, and ICT-based solutions are preferred to more traditional educational approaches.**

Keywords-Learning to learn, metacognition, learning strategies, science of learning

I. INTRODUCTION

The OECD Learning Framework 2030 [1] offers a vision for the future of education and identifies learning to learn as a key skill for learners to develop. Beyond its academic benefits, Laukkonen, Biddel and Gallagher [2] posit that acquiring meta-learning strategies can help safeguard learners against the volatility, uncertainty, complexity and ambiguity they will face in the future; as individuals are provided with both "a tool—and a valuable sense of agency—to embrace uncertainty as opportunity for learning." Developing the skill of learning can be conceptualized as knowing and being able to apply the principles and meta-learning strategies that make learning more efficient [2]. Examples of learning principles include those from the science of learning (i.e. how learning happens in the brain) related to how memories are formed and the overall malleability of the brain (i.e. neuroplasticity) [3]; and learning strategies such as retrieval (i.e. practice testing), spacing (i.e. distributed practice), interleaving, and elaboration [4]. However, having learners become proficient in meta-learning strategies often requires a change in behavior as studies reveal that most learners rely on inefficient learning strategies [5][6] and many are unable to distinguish efficient from inefficient strategies [7]. Moreover, altering learner approaches to learning and self-efficacy in a manner that lasts over time is difficult to achieve [8].

The Fogg Behavior Model (FBM) [9] provides a frame of reference for communicating about and devising strategies to influence learner behavior. FBM states that "for a target behavior to happen, a person must have sufficient motivation, sufficient ability, and an effective trigger." Triggers can also be thought of as cues or prompts to act. An understanding of these three factors (motivation, ability, triggers) and their interrelations are crucial when designing interventions for learners. For example, if learners lack motivation then the intervention must include approaches to develop the motivation of learners. Likewise, if learners lack ability, the intervention must address the lack of learner ability and strive to simplify the target behavior to one that the learner is capable of performing. As learning to learn has been identified as a key skill for learners, it is unclear to what extent and how the development of this skill is needed and supported in higher education. This leads to our research questions: Are university students motivated to improve their learning to learn skills? Do university students have the background knowledge and ability to make use of meta-learning strategies? Do university students prefer traditional, face-to-face educational solutions or information and communication technology (ICT) based solutions?

II. METHODS

To explore these questions, we conducted a quasi-experimental study in which participants completed two online surveys as part of a 2-hour class on learning to learn. A total of 201 first-year university students enrolled in a computer engineering degree program at a Spanish university were eligible to participate in the study. Data for the study was used from the students who attended the entire class and gave consent for their data to be used for research purposes.

The classroom lesson on learning to learn was an adaptation of material created in the Illuminated Project (www.illuminatedproject.eu) and was integrated into an Introduction to Engineering Studies academic course. In the lesson students were introduced to cognitive theories on learning and efficient learning strategies such as retrieval practice, distributed practice and spaced learning [10]. Students could either complete the class and survey in English or Spanish. Students completed the first survey in class at the start of the lesson. The second survey was completed outside of class with responses collected at the end of the day following the lesson. The first survey collected information about students' prior experiences, motivation, and beliefs about their abilities related to learning to learn (see Table 1). The second survey contained questions about students' perceptions of the lesson, motivation, and preferences related to potential solutions (see Table 2). The statistical analysis of

the data collected from the two online surveys was done using the R Studio software [11]. The following section presents the most relevant results of the exploratory study.

III. RESULTS

A total of 83 participants (50 male and 33 female) responded to the first survey and 67 (37 male and 30 female) to the second survey. The second survey was distributed after the completion of the 2-hour lesson which resulted in a lower response rate.

A. Learner motivation

In reference to the first research question on motivation, we analyzed the responses to questions 1G, 1H, 1I, and 1J as presented in Table 1. In short, we found that the vast majority of respondents (80.7%) agreed or strongly agreed that learning about the science of learning would be useful for students; less than half (44.6%) agreed or strongly agreed that a course on learning to learn should be mandatory for students; and 63.9% of respondents marked being motivated or highly motivated to learn about learning. On the other hand, 36.1% were neutral or not motivated to learn about learning. When asked to briefly explain their level of motivation, participants referred to the importance and usefulness of understanding and acquiring techniques for improving how they learn. Typical responses included the following examples: "I am motivated to improve my learning skills and have some more structure through techniques while learning"; "I must learn how to study and I wanna know more about how our brain works."

B. Prior knowledge and abilities

In reference to the second research question about student

background knowledge and abilities, we analyzed responses to questions 1A, 1B, 1C, 1D, 1E and 1F as presented in Table 1. We found that 83.1% of respondents had never taken lessons about the science of learning while over half (56.6%) reported they had taken lessons about effective learning strategies. In self-assessing their knowledge and abilities (i.e. questions 1D, 1E, and 1F), only 8.4% of students agreed that they felt they had received enough past schooling about the science of learning; few (13.3%) agreed that they were confident in their knowledge about learning; and the vast majority (83.1%) were unsure or disagreed that they used effective learning strategies. No respondents strongly agreed with any of the three statements. Question 1C asked students to mark the different manners in which they had learned about learning. Less than a third of the marked responses related to explicit learning approaches such as formal education (15%) and informal learning (15.8%) whereas relying on intuition (39.9%) was the most commonly marked response. Further, 16 participants (19.3%) reported that they had not explicitly learned about how learning happens/how people learn.

C. Learner Preferences

In reference to the third research question that explored learner preferences related to learning about the science of learning (see Table 2), students were asked to rate their level of interest in tradition educational approaches (2A, 2B, and 2C) and digital educational approaches (2D, 2E, and 2F). The results show that students prefer digital educational approaches ($Mode = 4$, $M = 3.37$, $SD = 1.1$) to traditional educational approaches (Mode = 3, $M = 2.89$, $SD = 1.0$). For example, while 35.8% of participants were interested or highly interested in lessons on study strategies based on science of learning concepts, 74.6% were interested or highly interested in a free online app that could help them apply effective study strategies and better understand the science of learning.

IV. DISCUSSION

We explored three research questions applicable to the design of learning to learn interventions in higher educational settings. Firstly, we examined university student levels of motivation related to improving their learning to learn skills and found that most students recognized the usefulness of learning about the science of learning (80.7%). However, only

TABLE I. FIRST SURVEY QUESTIONS: MOTIVATION, BACKGROUND

ID	Question
1A	As part of your formal education (e.g. at school), have you ever taken a lesson on the science of "how learning happens/how people learn"?
1B	As part of your formal education (e.g. at school), did you ever take a lesson on "how to learn" (e.g. effective learning and studying strategies)?
1C	How have you learned about the science of "how learning happens/how people learn"?
1D	I feel I have received sufficient schooling on the science of "how learning happens/how people learn"
1E	I think I learn and study in a manner that is consistent with the scientific literature on "how learning happens/how people learn."
1F	I am confident in my knowledge of the science of "how learning happens/how people learn". E.g. I would feel confident teaching it to a peer.
1G	Learning about the science of "how learning happens/how people learn" would be very useful for students.
1H	A lesson on the science of "how learning happens/how people learn" (e.g. cognitive and biological processes that underlie learning) should be mandatory for students.
1I	I am motivated to learn about the science of learning.
1J	Briefly explain your level of motivation.

TABLE II. SECOND SURVEY QUESTIONS: PREFRENCES

ID	Question
2A	Homework activity to help reinforce the lesson content
2B	Additional lessons on concepts from the Science of Learning
2C	Additional lessons on study strategies based on Science of Learning concepts
2D	A free online course (MOOC) on the Science of Learning for Students
2E	Downloadable resources about the Science of Learning
2F	A free online App to help you apply effective study strategies and better understand the science of learning

two-thirds of respondents were motivated to learn more about learning. According to the FBM this suggests that interventions may need to include targeted efforts to boost the motivation for those lacking it. Secondly, we explored the learning abilities of students via self-assessments and found that the vast majority (86.7%) lack confidence in their knowledge about learning; are unsure whether they use effective learning strategies (83.1%); and do not feel that they have received sufficient schooling regarding learning to learn. The results suggest that there is a need, as identified by students, to improve their knowledge and abilities related to learning. Finally, we looked into whether learners showed a preference for traditional, face-to-face educational solutions or information and communication technology (ICT) based solutions with regard to improving their learning to learn knowledge and skills. We found that traditional educational approaches such as mandatory courses, lessons or complementary homework are not viewed as favorably as ICT-based solutions such as online applications or platforms to share online resources.

The FBM states that "for a target behavior to happen, a person must have sufficient motivation, sufficient ability, and an effective trigger. All three factors must be present at the same instant for the behavior to occur [9]." Thus, for learning to learn interventions to successfully influence learner behavior, they need to account for the variability in learner motivation and learning skills; and reach the learner at times in which decisions about studying are being made. Personalized and adaptive technologies that develop learning to learn skills have the potential to attract learners with their capability to fulfill such requirements due to the clear preference of learners for ICT-based rather than traditional face-to-face approaches to learn about learning. Moreover, with such technologies being used in an ongoing manner, they may be more effective in helping students maintain the gains from learning to learn interventions and not regress to inefficient practices [8].

A. Limitations

Our study involved first-year university students in an engineering degree program which may limit the generalizability of the findings. Further, the surveys were not mandatory, and fewer students completed the second survey. Moreover, the questions about motivation were broad in their focus and did not explore participant rankings of core motivators in the FBM such as pleasure/pain, hope/fear, and social acceptance/rejection. Additionally, the data on learner abilities was taken from self-reported assessments rather than from a validated instrument for measuring knowledge and skills related to learning to learn.

B. Future directions

Future studies should explore the core motivators identified in FBM so that strategies to spark learners who lack motivation can be effectively created. In relation to understanding learner knowledge of and ability to use meta-learning strategies, objective and validated measures should be used to more accurately determine the prior knowledge of learners and assess the gains resulting from interventions.

V. CONCLUSION

Our study examined university student motivation, abilities and preferences related to a learning to learn intervention conducted in a higher educational setting. We found that most students recognize the importance of the science of learning, lack confidence in their knowledge about the skill of learning and are unsure about whether they use effective learning strategies or not. Yet, a third of students are not motivated to learn more about learning. Further, traditional educational approaches such as mandatory courses, lessons or complementary homework are not viewed as favorably as ICT-based solutions such as online applications or platforms to share online resources. These results suggest that there is both a need to help students acquire the ability to learn efficiently and a student preference for ICT-based solutions to facilitate such learning.

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