



BEYOND COMPETENCIES: NEW CHALLENGES IN A DIGITAL SOCIETY

Learning to learn: university student perceptions of a science of learning intervention

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1. ABSTRACT

Many students use ineffective learning strategies and lack confidence in their learning skills and knowledge. This paper presents the results of a pre- and post-survey study involving first-year university students that completed a 2-hour classroom lesson on the science of learning and learning skills. The results of the study confirm that students perceive that they lack knowledge and confidence about learning; and that students found a lesson on the science of learning to be beneficial.

2. KEYWORDS: 4-6

Learning skills, learning to learn, science of learning, metacognition



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3. DESENVOLUPAMENT:

Introduction

Many students use ineffective learning strategies resulting from a poor understanding and mismanagement of attention, concentration and information retention practices (Sauvé et al, 2018; Dattathreya & Shillingford, 2017). Moreover, these students often lack confidence in their learning skills and knowledge (Kisac & Budak, 2014). There is a need to help students better understand how learning happens and the strategies that can best support their learning in order to prepare them for an increasingly uncertain future (Laukkonen et al., 2018). Teaching students about theories from the science of learning such as those on how durable memories are formed and how neuroplasticity underlies learning (Cardinale & Johnson, 2017); in addition to introducing them to learning strategies such as distributed practice and retrieval practice (Dunlosky et al., 2013) may improve student confidence and efficacy related to their self-regulated learning. Similar approaches have led to improvements in student metacognitive awareness (Vrugt & Oort, 2008). This paper presents 1) the results of **a pre-survey on student beliefs related to the science of learning** completed by first-year university students in Barcelona, Spain; and 2) **student evaluations of a 2-hour lesson on learning skills** and the science of learning. The motivation for the study is to investigate whether there is a need to support first-year university students in learning to learn; and to gather feedback on an existing intervention as part of a design-based research approach (Cole, Purao, Rossi & Sein, 2005).

Learning Skills and the Science of Learning

A 2-hour lesson was created to teach first-year engineering degree students from a public university in Spain about the cognitive processes that underlie learning and to introduce evidence-based learning strategies such as retrieval practice (Figure 1). The lesson applied Spaced Learning methodology (Kelley & Watson, 2013), took place in the 2018-19 academic year, and was part of a face-to-face transversal skills lesson in an Introduction to Engineering Studies academic course. The lesson content was adapted from open educational material created by Project Illuminated (<http://illuminatedproject.eu/>). The learning objectives of the lesson were to increase student awareness of effective and ineffective learning strategies; and to motivate students to learn more about the science of learning.

Methodology

Students involved in the study answered a pre-survey prior to the lesson. The pre-survey (Table 1) investigated student beliefs related to the science of learning and learning skills. After the completion of the lesson, students received a link to an online post-survey (Table 2). The post-survey asked students to evaluate the lesson and to reassess their



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beliefs related to the science of learning and learning skills. Google Forms were used for the surveys. Ten classes participated in the study. Seven classes were conducted in Spanish and three classes were conducted in English. A total of 151 students participated in the study, with all participants answering the pre-survey and 103 students the post-survey.

Results/Analysis

A need to learn about learning

The results of the pre-survey are presented in Figure 2. We found that only 13.90% of students had previously taken a lesson on the science of learning (question 1.1); while 59.60% had taken a lesson on learning strategies (question 1.2). Only 13.91% of students agreed or strongly agreed that they felt they had received *sufficient* schooling on the science of learning; 29.23% agreed or strongly agreed that they were *confident* in their knowledge about learning; and 22.52% of students agreed or strongly agreed that they learned and studied in a manner that is *consistent* with the science of learning. Furthermore, 80.13% of students agreed or strongly agreed that a class about how learning happens would be *useful* for students; and 53.65% believed such a lesson should be *mandatory* for students.

Student perceptions of the science of learning

The results of the pre-survey are presented in Figure 3 and the differences between pre- and post-survey responses are presented in Table 3. After the lesson, we found that more students agreed or strongly agreed that they were *confident* in their knowledge about learning (from 31.13% to 47.57%); and that they learned and studied in a manner that is *consistent* with the science of learning (from 22.52% to 35.93%). Additionally, 84.47% of students agreed or strongly agreed that the intervention lesson was *useful* compared to 80.13% of students that previously agreed or strongly agreed that a class about how learning happens would be useful for students. More students also agreed or strongly agreed that a lesson on the science of learning should be *mandatory* for students (from 53.65% to 58.26%); a higher percentage (70.87%) agreed or strongly agreed that a lesson on learning strategies should be *mandatory* for students; and 62.14% of the students agreed or strongly agreed that it was clear for them that they could apply what they had learned during the lesson.

Lesson strengths and weaknesses

In evaluating the open question in the post-survey (question 2.7) related to the strong and weak points of the lessons, we found that most students wrote positive opinions about the content and dynamics of the lesson. Students stated that they had learned new concepts in an entertaining manner. Examples of student comments were: “The session was dynamic and interesting, so it wasn't boring at all.”, “Very interesting and captivating”. Some students mentioned weak points in which they stated that they found parts of the lesson repetitive and overly theoretical. Examples of student comments



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related to the weak points of the lesson are: “Too repetitive.”, “I think the main idea was great, the lesson was very interesting but I felt like I needed some more practical keys to apply all the theory”.

Discussion

“Teaching is facilitated or hampered by different strategies in learning” Hascher (2010). What students do, the strategies that they use, make a difference in how much learning takes place. However, students “often have a faulty mental model of how they learn and remember, making them prone to both misassessing and mismanaging their own learning” (Bjork, Dunlosky & Kornell, 2013). The results of the study confirm there is a need to teach university students about learning as many of the surveyed students responded that they felt they lacked prior schooling and confidence related to the topic of learning yet see the usefulness of learning about learning. Further, the post-survey results suggest that a 2-hour lesson on the science of learning can positively influence student beliefs about learning as after the lesson more students felt confident with their knowledge on how people learn. Moreover, in a follow up study conducted with the 2019-20 cohort of students, we aimed to better inform future learning to learn interventions by identifying student levels of motivation, ability, and preferred mediums related to learning about learning (Beardsley, Gutiérrez & Hernández-Leo, 2020). Results of the study similarly found that 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” (p. 348). Moreover, the study discovered that a third of students were not motivated to learn more about learning and students preferred ICT-based solutions such as online applications or platforms to share online resources to course work to support their development of learning skills.

Limitations

Our study involved a single, 2-hour lesson and was conducted in an authentic setting with first-year university students in an engineering degree program. It is unclear how generalizable and durable the findings are. Many students do not use effective learning strategies (Hartwig & Dunlosky, 2012) and are likely to maintain or revert to the strategies they have regularly used in the past, unless the use of the new learning strategies is reinforced by instructors (Papinczak et al., 2008). Secondly, the research surveys were not mandatory and not all students completed the post-survey. Thus, there is a chance that the students that perceived a lower benefit from the lesson did not respond to the survey, thereby biasing the post-survey responses in favor of the lesson and its impact. Finally, the usefulness of the lesson was assessed using a qualitative survey rather than a validated instrument for measuring student learning.



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Future work

Future work can extend this line of research to investigate whether the positive influence on student beliefs about learning leads to a greater adoption of effective learning strategies and, subsequently, improvements in students' academic achievements, motivation, and satisfaction with university. Future studies would benefit from the development of a validated instrument to measure student learning about learning skills and the science of learning to assess to what extent the lesson impacted student learning behaviours. In addition, the science of learning lesson intervention used can be improved to address the weak points raised by students. Addressing the weak points could include reducing the amount of theoretical content and increasing the amount of practical content such as providing more concrete examples on how to apply effective learning strategies. Moreover, it may be worthwhile to explore extending the intervention to consist of multiple lessons to better support student learning of the theoretical concepts that underlie learning and provide ample opportunities for students to practice applying the effective learning strategies.

Conclusion

We presented the results of a pre- and post-survey study involving first-year university students who completed a 2-hour classroom lesson on the science of learning. The results of the pre-survey revealed that students believed that they lacked prior schooling, knowledge and confidence about learning. The results of the post-survey showed that a 2-hour lesson on the science of learning and learning skills positively influenced student beliefs about learning and students found the lesson to be beneficial.

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3.1. TABLE 1

Table 1. Pre-survey questions

ID	Theme	Question (English)	Question (Spanish)
1.1	Previous training (science of learning)	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" (e.g. cognitive and biological processes that underlie learning)?	Como parte de tu educación formal (por ejemplo, en la escuela), ¿te fue requerido completar un curso sobre la ciencia de "cómo sucede el aprendizaje / cómo aprende la gente" (por ejemplo, procesos cognitivos y biológicos que subyacen al aprendizaje)?
1.2	Previous training (learning strategies)	As part of your formal education (e.g. at school), have you ever taken a lesson on "how to learn" (e.g. effective learning and studying strategies)?	Como parte de tu educación formal (por ejemplo, en la escuela), ¿has tomado alguna vez una lección sobre "cómo aprender" (por ejemplo, aprendizaje efectivo y estrategias de estudio)?
1.3	Sufficiency	I feel I have received sufficient schooling on the science of "how learning happens/how people learn"	Siento que he recibido suficiente educación sobre la ciencia de "cómo sucede el aprendizaje / cómo aprende la gente"
1.4	Consistency	I think I learn and study in a manner that is consistent with the scientific literature on "how learning happens/how people learn."	Creo que aprendo y estudio conforme a la literatura científica sobre "cómo se produce el aprendizaje / cómo aprenden las personas".
1.5	Confidence	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.	Confío en mi conocimiento de la ciencia sobre "cómo se genera el aprendizaje / cómo aprende la gente". P.ej. Me sentiría confiado enseñándolo a un compañero.
1.6	Usefulness	Learning about the science of "how learning happens/how people learn" would be very useful for students.	Creo que sería útil para los/as estudiantes aprender la actual ciencia sobre "cómo sucede el aprendizaje / cómo aprende la gente".
1.7	Mandatory	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.	Una lección sobre la ciencia de "cómo ocurre el aprendizaje / cómo aprende la gente" (por ejemplo, los procesos cognitivos y biológicos que subyacen en el aprendizaje) debería ser obligatoria para los estudiantes.

3.2. TABLE 2

Table 2. Post-survey questions

ID	Theme	Question (English)	Question (Spanish)
2.1	Consistency	I think I learn and study in a manner that is consistent with the scientific literature on "how learning happens/how people learn."	Creo que aprendo y estudio conforme a la literatura científica sobre "cómo se produce el aprendizaje / cómo aprenden las personas".
2.2	Confidence	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.	Confío en mi conocimiento de la ciencia sobre "cómo se genera el aprendizaje / cómo aprende la gente". P.ej. Me sentiría confiado enseñándolo a un compañero.
2.3	Usefulness	The lesson is useful for students.	La lección es útil para los estudiantes.
2.4	Applicability	It is clear to me that I can apply what I learned.	Veo claramente que puedo aplicar lo que aprendí.
2.5	Mandatory	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.	Una lección sobre la ciencia de "cómo ocurre el aprendizaje / cómo aprende la gente" (por ejemplo, los procesos cognitivos y biológicos que subyacen en el aprendizaje) debería ser obligatoria para los estudiantes.
2.6	Mandatory (learning strategies)	A lesson on "how to learn" (e.g. effective learning and studying strategies) should be mandatory for students.	Una lección sobre "cómo aprender" (por ejemplo, aprendizaje efectivo y estrategias de estudio) debería ser obligatoria para los estudiantes.
2.7	Evaluation	What did you think of the lesson on the science of learning (strong points, weak points)?	¿Qué te pareció la lección sobre la ciencia del aprendizaje (puntos fuertes, puntos débiles)?



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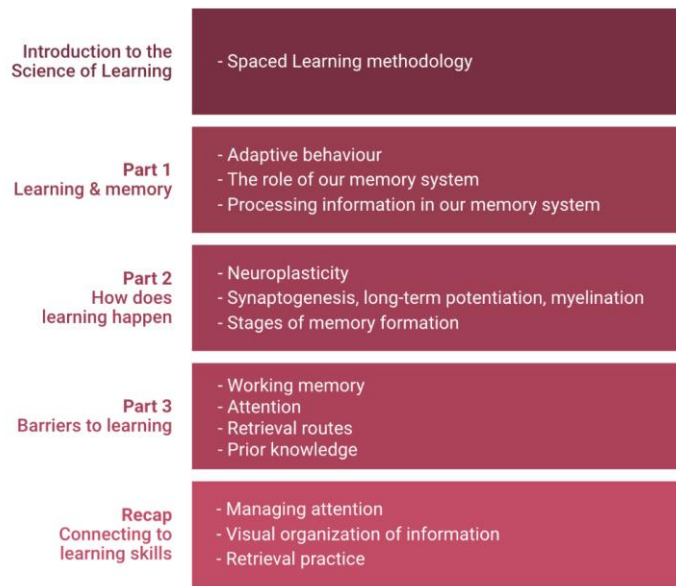
3.3. TABLE 3

Table 3. Pre- and post-lesson rating differences

	Consistency	Confidence	Usefulness	Mandatory
Strongly disagree	+1.85%	-8.70%	+0.26%	+0.71%
Disagree	+0.21%	-11.26%	+1.54%	+1.72%
Neither agree nor disagree	-15.47%	+3.52%	-6.14%	+5.62%
Agree	+8.60%	+10.36%	+0.82%	+1.04%
Strongly agree	+4.81%	+6.09%	+3.52%	+3.57%

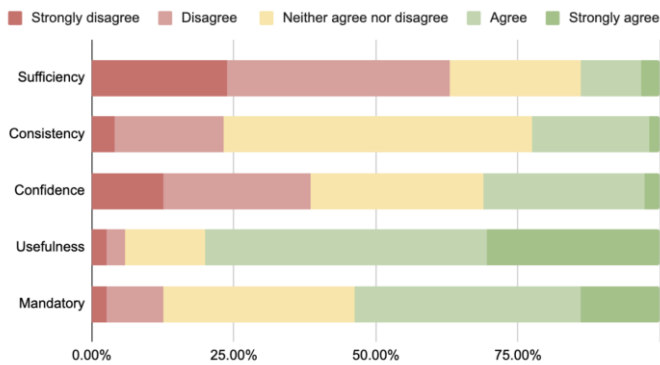
3.4. FIGURE 1

Figure 1. Schema of the 2-hour lesson on the Science of Learning



3.5. FIGURE 2

Figure 2. Pre-lesson beliefs about the science of learning

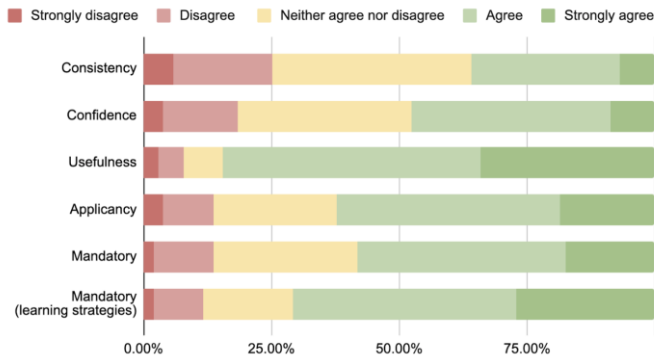




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3.6. FIGURE 3

Figure 3. Post-lesson beliefs about the science of learning and the lesson



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