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# Insights into study strategies and habits: a pilot study with undergraduate students in Spain and the UK

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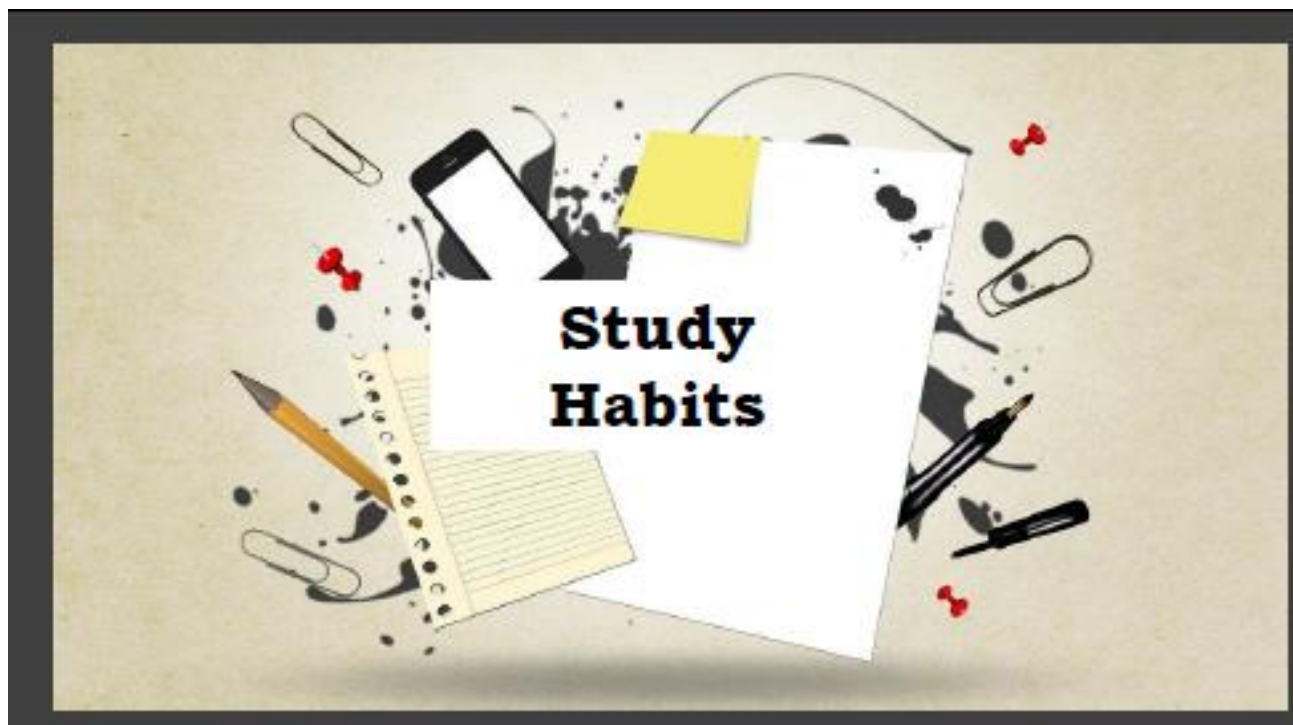
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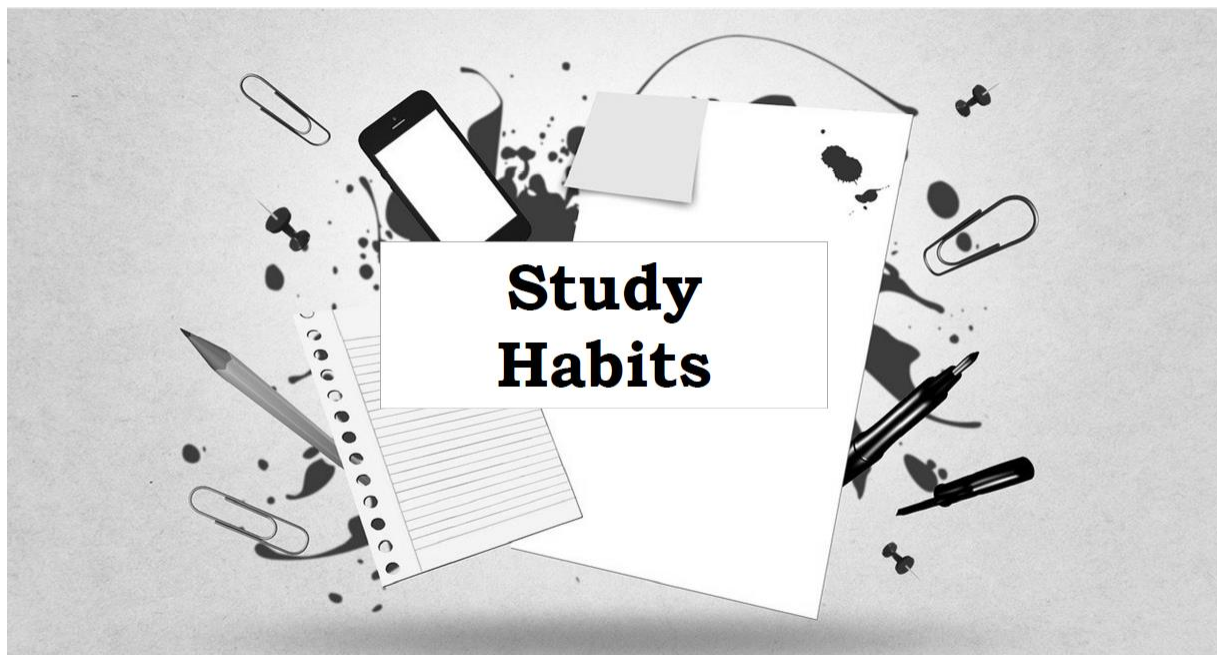
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## ABSTRACT

The approach that students take in their studies at university is critical not only for their academic success but is equally important in life-long learning for their career and professional development. Cognitive science has demonstrated that re-testing oneself on material when learning, enhances and promotes greater retention of knowledge compared to rereading the material. Learning that is spaced out over multiple study sessions also allows for greater retention of knowledge in the longer-term compared to 'cramming' of information. A pilot survey study with first- and second-year undergraduate students (n=135) at a university in Spain and in the UK was carried out to investigate the study strategies and habits prevalent in these cohorts and the extent of metacognitive awareness of such evidence-based study approaches. It was found that most students endorsed self-testing but also suboptimal study methods such as re-reading, copying notes, underlining and highlighting material. There was evidence of metacognitive awareness with retrieval practice and distributed practice reported for both cohorts in Spain and the UK.

## 20 GRAPHICAL ABSTRACT





## KEYWORDS

General, Interdisciplinary, Self-instruction, Learning Theories

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Study habits and approaches to study are important in higher education particularly where independent adult learning is encouraged and promoted. The decisions made by students can directly influence educational outcomes such as academic performance and attrition. Metacognition, the ability to know, monitor and regulate knowledge during studying is an important skill.<sup>1</sup> There is a growing research base that supports effective study strategies with much evidence on distributed practice and retrieval practice. Retrieval of information or the testing effect produces large gains in long-term retention relative to rereading and restudying of material.<sup>2</sup> A study using general scientific material found that students in the repeated-testing condition recalled more after a week compared to students in the repeated-study condition (61% vs 40%).<sup>3</sup> The repeated-study condition group read the material 14.2 times compared to 3.4 times in the repeated-testing condition group. Distributed practice or the spacing effect where study periods are spaced out over time shows enhanced learning as opposed to cramming study in a single session.<sup>4</sup> This effect has a long history of research extending back to Ebbinghaus and his classical memory studies which have been replicated.<sup>5</sup> Despite the

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40 effectiveness of retrieval practice and self-testing, it is found that when students are self-studying, they do not implement these strategies.<sup>6</sup>

Research by Hartwig and Dublosky<sup>7</sup> on the study strategies of US college students found that testing, rereading and cramming are commonly reported study strategies with higher performing students more likely to choose effective study strategies and have greater awareness on the benefits of self-testing. Geller et al<sup>8</sup> obtained similar results with a slightly modified survey instrument. They  
45 found that avoidance goals (e.g. fear of failure) coincided with increased cramming and students were more influenced by impending deadlines than by a planned study schedule.

The importance of what students are thinking when studying rather than what they are doing is an important consideration. Metacognitive awareness in relation to the benefits of retrieval practice and distributed practice confirms that students are not necessarily implementing such effective study  
50 approaches. It was reported for general chemistry students that all were consistent in their reports of amount of quality time studying but there was a difference in the use of a practice exam as a resource.<sup>9</sup> The research evidence suggests that students can underpredict their learning and discontinue studying and succumb to 'stability bias'.<sup>10</sup> At risk students in general chemistry self-  
55 reported via text message their frequency of studying throughout the term and not surprisingly from a multiple regression analysis, high frequency of studying could mitigate at risk status on final exam scores. Interviews of six at-risk students found that the quality of studying was not linked to the frequency of studying.<sup>11</sup>

A study survey by Blasiman et al<sup>12</sup> that considered the study strategies, hours of study and  
60 distribution of study over time found that initially, intentions to use effective strategies were evident but during the semester, students relied on relatively ineffective strategies and crammed studying ahead of an exam. An established survey<sup>7</sup> was used in a pilot study with undergraduate students in chemistry modules at a university in the UK and in Spain. Previous studies have focused on psychology<sup>7, 13, 14</sup> and biology courses<sup>8</sup> and it was of interest to explore the reported study strategies  
65 and habits among students studying chemistry courses in two distinct geographical locations.

Research Question: What differences in metacognitive awareness of effective study approaches exist between undergraduate students at a university in the UK and Spain?

## METHOD

The modified survey of 11 questions<sup>8</sup> was administered as a paper-based survey during class sessions to first- and second-year undergraduate students at the University of Hertfordshire, UK and Universidad Castilla-La Mancha, Spain. All students involved were studying on general applied chemistry programs: Food Technology (1<sup>st</sup> year Spain), Chemical Engineering (2<sup>nd</sup> year Spain), Pharmaceutical Science (1<sup>st</sup> year UK) and Pharmacy (2<sup>nd</sup> year UK). The sample of students and course details are as follows: 1<sup>st</sup> year UK, Foundations of Pharmaceutical Chemistry (n=34), 1<sup>st</sup> year Spain, Food Technology (n=16), 2<sup>nd</sup> year UK, Pharmaceutical and Chemical Analysis (n=49) and 2<sup>nd</sup> year Spain, Chemical Engineering (n=36). Demographic data questions for gender and age were also included in the survey instrument. The research project was approved by the ethics board at the University of Hertfordshire.

## RESULTS AND DISCUSSION

A total of 135 first- and second-year undergraduate students in the UK and Spain were surveyed on their study approaches. Of the 135 students, 66.7% (n=90) were female, 25.9% (n=35) male and 7.4% (n=10) did not specify. The ages reported ranged from 18 to over 25; 13.4% (n=18) were 18 years, 65.7% (n=88) ranged between 19-21 years, 14.9% (n=20) were between 22-25 years and 6% (n=8) reported to be over the age of 25. The results were evaluated comparing the cohorts from the UK and Spain. Table 1 shows the survey results for Q1-10.

**Table 1. Study approaches questionnaire (Q1-10) and percentage responses for students in Spain and in the UK**

Question	Answer Options	Percentage responses for students in Spain	Percentage responses for students in UK
Would you say that you study the way you do because a teacher (or teachers) taught you to study that way?	Yes	17.3%	9.6%
	No	82.7%	90.4%
How do you decide what to study next?	<input type="checkbox"/> Whatever's due soonest/overdue	40.4%	61.4%
	<input type="checkbox"/> Whatever I haven't studied for the longest time	1.9%	9.1%
	<input type="checkbox"/> Whatever I find interesting	1.9%	3.4%
	<input type="checkbox"/> Whatever I feel like I'm doing the worst in	28.8%	13.6%
		26.9%	12.5%

	<input type="checkbox"/> I plan my study schedule ahead of time, and I study whatever I've scheduled		
Do you usually return to course material to review it after a course has ended?	Yes	19.2%	45.1%
	No	80.8%	54.9%
All other things being equal, what do you study more for?	<input type="checkbox"/> Essay/short answer exams	30.8%	29.3%
	<input type="checkbox"/> Multiple-choice exams	3.8%	14.6%
	<input type="checkbox"/> About the same	65.4%	56.1%
When you study, do you typically read a textbook/article/other source material more than once?	<input type="checkbox"/> Yes, I re-read whole chapters/articles	15.4%	22.9%
	<input type="checkbox"/> Yes, I re-read sections that I under-lined/highlighted/ marked	40.4%	39.8%
		44.2%	37.3%
	<input type="checkbox"/> Not usually		
If you quiz yourself while you study (either using a quiz at the end of a chapter, or a practice quiz, or flashcards, or something else), why do you do so?	<input type="checkbox"/> I learn more that way than I would through rereading	15.4%	20.0%
	<input type="checkbox"/> To figure out how well I have learned the information I'm studying	57.7%	50.6%
		5.8%	10.6%
	<input type="checkbox"/> I find quizzing more enjoyable than reading	21.2%	18.8%
	<input type="checkbox"/> I usually do not quiz myself		
Imagine that in the course of studying, you become convinced that you know the answer to a certain question (e.g., the definition of a term). What would you do?	<input type="checkbox"/> Make sure to study (or test yourself on) it again later	75.0%	63.9%
	<input type="checkbox"/> Put it aside and focus on other material	25.0%	36.1%
What time of day do you most often do your studying?	<input type="checkbox"/> Morning	5.3%	16.4%
	<input type="checkbox"/> Afternoon	15.8%	17.2%
	<input type="checkbox"/> Evening	57.9%	34.4%
	<input type="checkbox"/> Late night	21.1%	32.0%
During what time of day do you believe your studying is (or would be) most effective?	<input type="checkbox"/> Morning	32.7%	36.7%
	<input type="checkbox"/> Afternoon	7.7%	16.5%
	<input type="checkbox"/> Evening	50.0%	25.7%
	<input type="checkbox"/> Late night	9.6%	21.1%
Which of the following best describes your pattern of study?	<input type="checkbox"/> I most often space out my study sessions over multiple days/weeks	63.5%	47.1%
	<input type="checkbox"/> I most often do my studying in a couple of sessions before the test	34.6%	42.4%
		1.9%	10.6%
	<input type="checkbox"/> I most often do my studying in one session before the test		

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Most of the students, both in the UK and Spain (87.4%, n=118) reported that the study strategies they employed were not taught to them previously by teachers. In relation to organization of study and what to study next, 61.4% (n=54) of the UK students indicated to prioritize their study around  
90 upcoming deadlines and whatever is due soonest. This was also the priority for the students in Spain. A higher response from students in Spain was reported in relation to studying what they were doing worst in (28.8%, n=15) compared to students in the UK (13.6%, n=12). Using a plan and schedule to prioritize study was also reported higher for students in Spain compared to the UK. Research shows that a significant proportion of students' study decisions largely tend to be influenced by upcoming  
95 deadlines.<sup>7, 8, 14</sup> The first-year students in Spain responded highest for 'whatever I feel like I'm doing the worst in' (50%, n=8) whereas whatever was due soonest was highest for the first-year (45.7%, n=16) and second-year students (71.7%, n=38) in the UK and the second-year students in Spain (44.4%, n=16). The second-year students in Spain also scored planning study ahead of time highly (30.6%, n=11) compared to the second-year students in the UK (11.3%, n=6). Students in the UK have  
100 summative assessments throughout the year (progress test, laboratory reports, assignments) and a final exam at the end of the year (contributing 50%). In Spain, students are assessed with formative tests, laboratory experiments and a final summative exam at the end of the year (contributing 70%). Students in both cohorts have a schedule of deadlines that appears to drive decisions on what to study next.

105 Returning to review course material was not the predominant strategy reported by students in both the UK and Spain. Only 19.2% (n=10) of the students in Spain reported to return and review compared to 45.1% (n=37) of the students in the UK. Previous research showed that most undergraduate students in the US did not usually return to review course content after it had ended.<sup>7,</sup>  
<sup>8</sup>The results obtained from this current study may be explained by the curriculum design of the  
110 courses in the UK and Spain. In the UK, the courses are integrated throughout a programme of study where aspects of learning are taught and contextualised to other topics both across a year of study and between years of study. This focus to support a deeper approach to learning where concepts are developed in a more complex manner, facilitating integrative learning of course content throughout the undergraduate degree. For the students in Spain, the Food technology and Chemical engineering

courses are taught to students as an individual topic. The links and connections within courses are not explicitly emphasised to students so it is possible that the students treat the courses as unrelated pieces of knowledge.

When students study most often and students' beliefs about the most effective time of day illustrated some interesting points. Figure 1 illustrates the responses reported for each cohort.

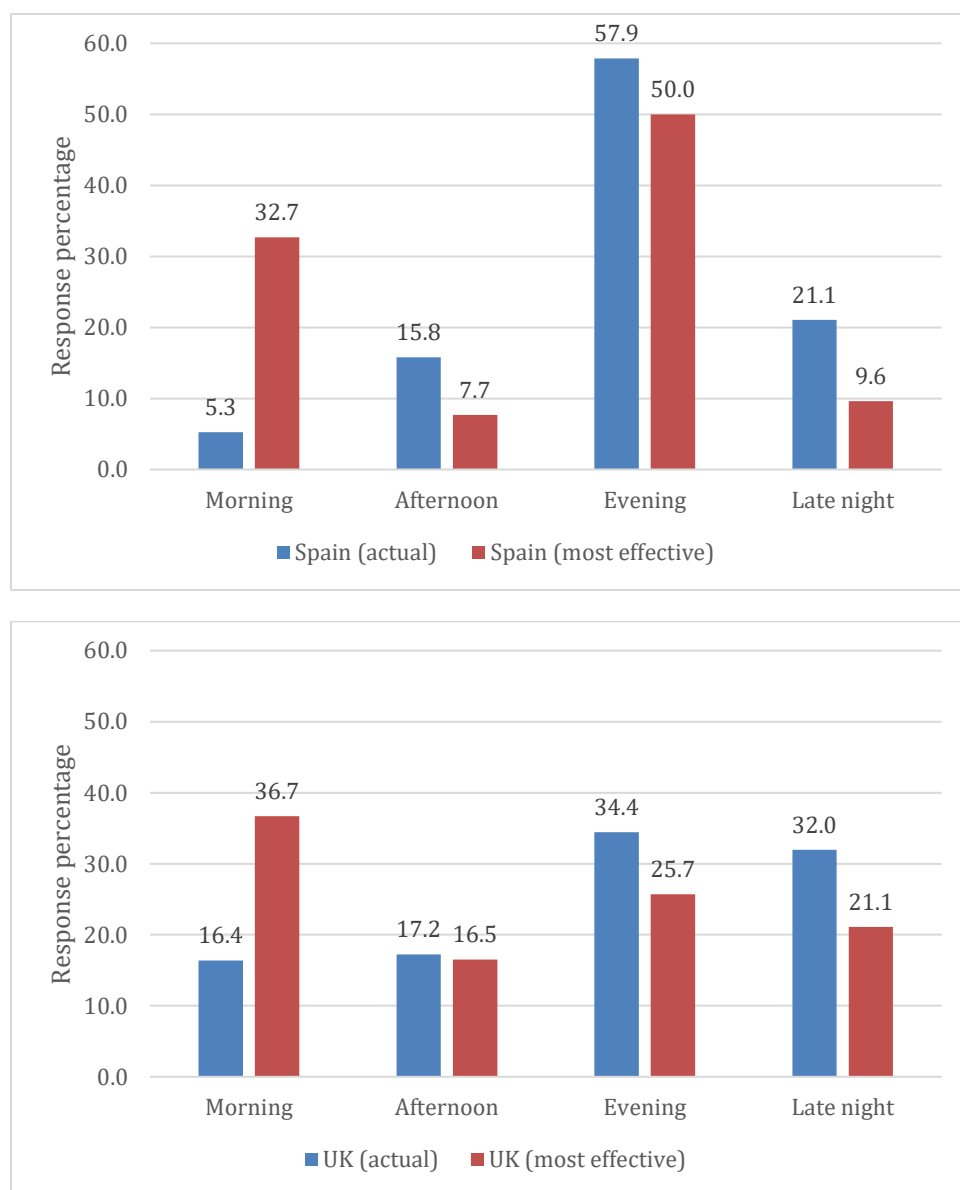


Figure 1. Responses for cohorts in Spain and the UK to the survey questions 'What time of day do you most often do your studying?' and 'During what time of day do you believe your studying is (or would be) most effective?'

125 Fewer students in both the UK and Spain reported that they most often studied in the morning and the evening was most popular time window followed by late night. Both cohorts believed that studying in the morning is most effective (top response for students in the UK and second for students in Spain) and this response is higher than the actual morning-time study reported.

130 Variations between the cohorts may be due to individual differences and scheduling differences between students in the UK and Spain. In Spain, the food science and technology course are taught lectures daily from 9am to 2pm and are scheduled laboratory sessions throughout the week which run for four hours after their lectures. Hence, the students are available in the evening and late night for their independent studying. The schedule of students in the UK is more flexible with a varied schedule each day including some days with fewer scheduled activities or gaps between scheduled activities.

135 Cramming studying in one session before a test was the lowest response reported across both cohorts. In the UK, almost half the students space out studying over days/weeks but equally 42.4% (n=36) study in a couple of sessions before the test. In Spain, 63.5% (n=33) space out their studying over days/weeks with 34.6% (n=18) studying in a couple of sessions before the test. Table 2 shows the study strategies used regularly from Q11 of the survey.

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**Table 2. Study strategies (Q11) reported for students in Spain and the UK**

<i>Which of the following study strategies do you use regularly? (Please check off all that apply).</i>	<i>Number of responses (percentage) for students in Spain</i>	<i>Number of responses (percentage) for students in UK</i>
<input type="checkbox"/> Test yourself with questions or practice problems	30 (57.7%)	52 (62.7%)
<input type="checkbox"/> Use flashcards	5 (9.6%)	21 (25.3%)
<input type="checkbox"/> Recopy your notes	23 (44.2%)	50 (60.2%)
<input type="checkbox"/> Reread chapters, articles, notes, etc.	31 (59.6%)	40 (48.2%)
<input type="checkbox"/> Make outlines	25 (48.1%)	18 (21.7%)
<input type="checkbox"/> Underline or highlight while reading	42 (80.8%)	45 (54.2%)
<input type="checkbox"/> Make diagrams, charts, or pictures	6 (11.5%)	38 (45.8%)
<input type="checkbox"/> Study with friends	17 (32.7%)	28 (33.7%)
<input type="checkbox"/> "Cram" lots of information the night before the test	9 (17.3%)	34 (41.0%)
<input type="checkbox"/> Ask questions or verbally participate during class	8 (15.4%)	12 (14.5%)



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Other

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2 (2.4%)

Please describe:

*Watch videos*

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When asked about specific study strategies adopted regularly, the highest reported strategy in Spain (third highest in the UK) was underlining or highlighting while reading. For the UK students, the highest reported strategy was testing with questions or practice problems. Over half the students  
145 (60.2%) in the UK are recopying their notes. Students in the UK are recommended textbooks for reading and the lecture slides are available to view and download via the online portal. These combined with notes taken during the lecture are the possible sources for their notes. With reading a textbook/article/other source material more than once (Q5 survey), both cohorts indicated two patterns with students re-reading sections that they highlighted or not usually re-reading material  
150 more than once.

The number of responses in the UK (62.7%, n=52) and in Spain (57.7%, n= 30) for using test questions and practice problems was high and supported by Q6 in the survey where half of the cohorts used this approach to test their learning. Self-testing strategies such as testing with practice problems or questions are one of the top three study strategies used across both cohorts. Over half of  
155 the cohorts reported this strategy to figure out how well they have learned the information. However, while the majority did self-test, 21.2% (n=11) of students in Spain and 18.8% (n=16) of students in the UK reported that they did not usually test themselves. Similarly, research on US undergraduate students reported testing as a method to evaluate what they have learned.<sup>7,8, 10</sup>

Students in the UK, compared to Spain, reported higher to making diagrams, charts pictures  
160 (45.8% vs 11.5%) and cramming before the test (41% vs 17.3%). The use of underlining or highlighting while reading was reported higher for students in Spain (80.8% vs 54.2%) as was makes outlines (48.1% vs 21.7%).

Fewer UK students (14.5%, n=12) and Spanish students (15.4%, n=8) indicated to ask questions and verbally participate in class. A survey study by Bowers<sup>16</sup> found that 70% of students reported  
165 having the experience of classroom communication apprehension. There are several reasons that have

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been shown to contribute to non-participation in class; logistics (class size, timings), intimidation and communication apprehension, personality traits of students and instructor/classroom climate.<sup>17, 18</sup>

Incorporating distributed practice and retrieval practice were evident from the highest reported response in relation to a question on returning to material (e.g. the definition of a term). This differs to previous research where most students put it aside and focused on other material.<sup>7</sup>

## IMPLICATIONS OF FINDINGS AND CONCLUSION

In this pilot survey study of students in Spain and the UK, there is evidence of metacognitive awareness in relation to effective study methods such as self-testing (retrieval practice) and spacing out study sessions (distributed practice). However, some students are not, instead they are using suboptimal methods of study such as recopying notes, rereading material and cramming. Previous research that examined study approaches and achievement found that low performers were likely to rely on impending deadlines rather than planning and were also more likely to engage in late night studying. Higher performers endorsed self-testing and planned their studying ahead of time.<sup>7, 8, 15</sup>

There are some implications for future research in relation to individual differences in students' approaches to studying. It is not clear if students are indeed aware of effective study strategies which create 'desirable difficulty' but choose suboptimal and less demanding methods closer to exams. With the global COVID-19 pandemic and the pivot to online delivery of teaching and assessment, the impact on students' study habits and strategies is not clear. The inclusion of study strategies in curricula would help inform students of evidence-based practices and perhaps increase the influence of the teacher in the way that students approach their studying.

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