2021 cohort

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The effectiveness of an online platform in memory recall and application of key scientific terms

Introduction and Literature Review

In order to effectively learn, students require a solid foundational knowledge upon which to build new knowledge (Furst, 2018). Learning is the process by which students are able to store, recall and apply information from their long-term memory (Willingham, 2010). Storage in the long-term memory involves not only the receival of content, but also the regular recall of this knowledge as well as placing the information in relevant contexts with strong connection established between the pieces of information (Willingham, 2010; Frust, 2018). Frust (2018) summarises the neuroscience of retrieval as the introduction of a new concept, creating links between these newly introduced concepts as consolidation and then storage. For this new information to be stored and learnt, it is important that efficient retrieval of the information is practiced regularly (Ebbinghaus, 1880; Karpicke & Roediger, 2008). Through continual and regular recall, memory retention is increased and decreases as a slower rate, and after five recall practice opportunities, the information is nearly-all retained (Ebbinghaus, 1880). True learning cannot in fact be observed, but assumptions and inferences can be made based on students' performance (Willingham, 2009). In fact, it has been found that students do not use logical inferential processes to understand and explain new phenomena, but rather focus on pattern completion understanding based on perceptual recognition and phenomena (Tytler & Prain, 2009). This is why it is vital that teachers support students in establishing strong connections between information stored in the long-term memory and new information being delivered, to prevent the creation of misconceptions based on poor understanding or perceptions (Frust, 2018).

Science as a subject relies on the understanding of key terms to apply to new concepts and ideas (Smailes, 2018). It can be argued that for a student to be successful in science, they require a whole new vocabulary, similarly to that of a student learning a modern foreign language. In order to enable students to access the lessons and new concepts in science (as well as other subjects), many schools have implemented knowledge organisers (Smailes, 2018). These resources highlight the key terms required in the subject with the appropriate and accessible definition. Students are required to recite these definitions in preparation for lesson and are often set homework on the recital of these definitions from memory. There are several reasons for this, firstly, if students have a good foundational knowledge of concepts, they are able to build upon this with new information and make long-lasting connections between knowledge (Reif, 2010; Willingham, 2010). It also aims for understanding and fluency of these terms, allowing for a more efficient classroom, as teachers do not have to spend a long time teaching new terminology but can rather focus on the key concepts of them and the understanding thereof (Reif, 2010; Smailes, 2018).

In recent years, especially since the disruption to leaning during the pandemic, education has been moving towards the inclusion of technology in the classroom and more importantly at home.

Students make use of online platforms for learning, revision as well as homework in the form of quizzes. These resources provide platforms which present taught information to students in a new way, aiming to improve their engagement and understanding (Alonso, 2005).

In this study, students will make use of an online learning platform to support their recall and understanding of key scientific terms from their knowledge organiser required as core foundational knowledge to build upon. The students will use an online platform to practice recall of the terms and their definitions in a different format to their current mode of learning. The students currently use a method of 'read, cover, write' whereby they read a definition and try to recall it from memory by writing the definition down on a page. They will then check their answers and correct accordingly. They will continue to do so until they have the definition correct and should be practicing these definitions several times over the week that the homework is due in. On the day that the knowledge organiser homework is due, they are expected to be able to recite the definition during a five-minute test, often with a scaffold such as a gap fill in place. This test is high stakes, as if they do recall at least four of the five definitions with a 100% accuracy, they receive a sanction (a point towards a detention later in the week). The effectiveness of this has not been assessed and often students end up cramming the definition into their short-term memory just before the lesson. This reduces their engagement and retainment of the definitions, limiting their application of the definitions to the lessons. This study will make use of the online platform Carousel which uses flash cards and is a low-stake quiz format during which students can test their effective recall of the five-definition allocated as homework. The aim is to test whether the additional support of an online platform provides an effective tool to first enable students to complete their definition recall effectively and given that the platform provides a selection of formats, e.g., flash cards, and quizzes, whether these different methods of engagement allow students to access the definitions easier. The data will be collected from the students results on their knowledge tests prior, during and after the intervention has been put in place.

There are a few limitations of this study: the first is that the study will rely on the assumption that the students will effectively engage with the online platform at home and although this can be checked using Carousel, we are unable to assess whether the student has truly tested themself or copied the definition from their knowledge organiser. Another limitation is that the format of the online quiz does not take the same format as the test during lesson and finally, although the whole class data will be collected, a student's performance can vary based on several factors, such as environment, attitudes etc. However, to mitigate this limitation, data will be aggregated, and inferences will be made across the whole duration of the study, rather than on a test-by-test basis.

Methodology

This project will use an online platform to provide a different method of memorisation and recall for students to engage and learn these terms and definitions. This was set as homework for a Year 8 top set class of 30 students. The five selected terms and definitions on their knowledge organiser were uploaded to the online platform Carousel. Carousel is an existing platform that teachers can use to set quizzes for students. On Carousel, students able to recite the definitions using flashcards and then once they are confident with the terms and definitions, the students can quiz themselves by reciting the definition. The students then wrote the KO test during lesson and data was collected on student scores and compared to data collected prior to the intervention. The intervention will took place over a half term.

Knowledge organisers and definitions had already been created and definitions selected for the half term. Terms and definitions were uploaded to Carousel and the quizzes were set every fortnight

for the students. Both the online platform and the individual results of KO tests were checked every fortnight.

The key stakeholders in this project are the teaching staff, teaching and learning leads as well as the students. As knowledge organisers and KO tests are set across the school, this project not only impacts the Science department, but if the intervention in successful, it could potentially be implemented across the whole school, and very likely across the Science department. Although the idea behind the knowledge organiser is based on cognitive research, the implementation of it has been questioned regarding how effective it is. This project has been developed with the head of department and has buy-in from the curriculum leads.

The primary risk was that students will not complete the intervention at home – this was be mitigated by ensuring clear communication of the purpose of the project as well as sanctions for not completing it. Another risk is that students may not recite the definitions from memory at home – this was mitigated by having a large proportion of students completing the tasks, therefore allowing for identification of anomalies.

The plan was communicated to all students involved as well as stakeholders within the Science department and T&L leads. The intervention took place over the November-December half term, with more data collected in the January-February half term.

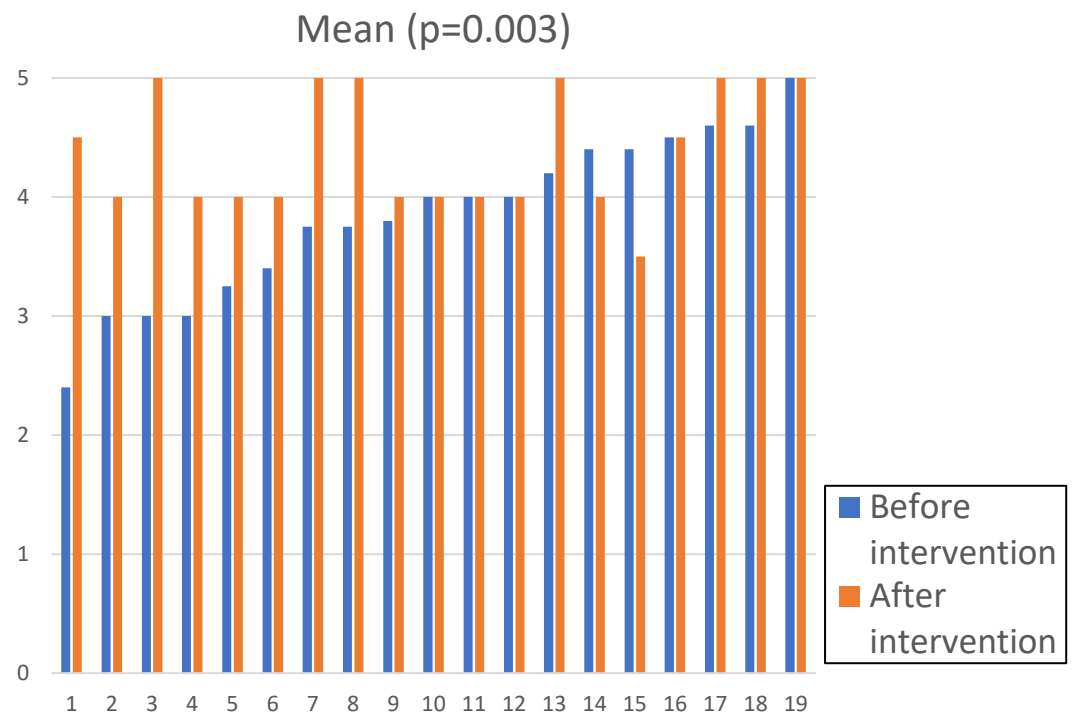
Results

Data collection

This study was carried out from December to March with 19 students. The initial sample size was 30, but after Key Stage 3 assessments, the students' changed sets and therefore classes. Due to the logistical difficulties to keep track of students' completion and KO scores (as well as test environment), it was decided to focus on the students that remained in my class. Throughout the study, testing conditions and were kept the same with students expected to memorise terms and definitions and partially complete these at the start of lessons every fortnight. Students' completion of the recall quizzing was monitored on the platform Carousel.

A total of 7 quizzes was used to produce data for student scores. Data from 5 quizzes was collected prior to the intervention, while due to time constraints, data from only 2 quizzes was collected with the intervention in place. The data was collected and analysed in Excel with mean and median students' pre-intervention scores and post-intervention scores compared using a paired one-tailed t-test.

Results


Mean (p=0.003)
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2
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0
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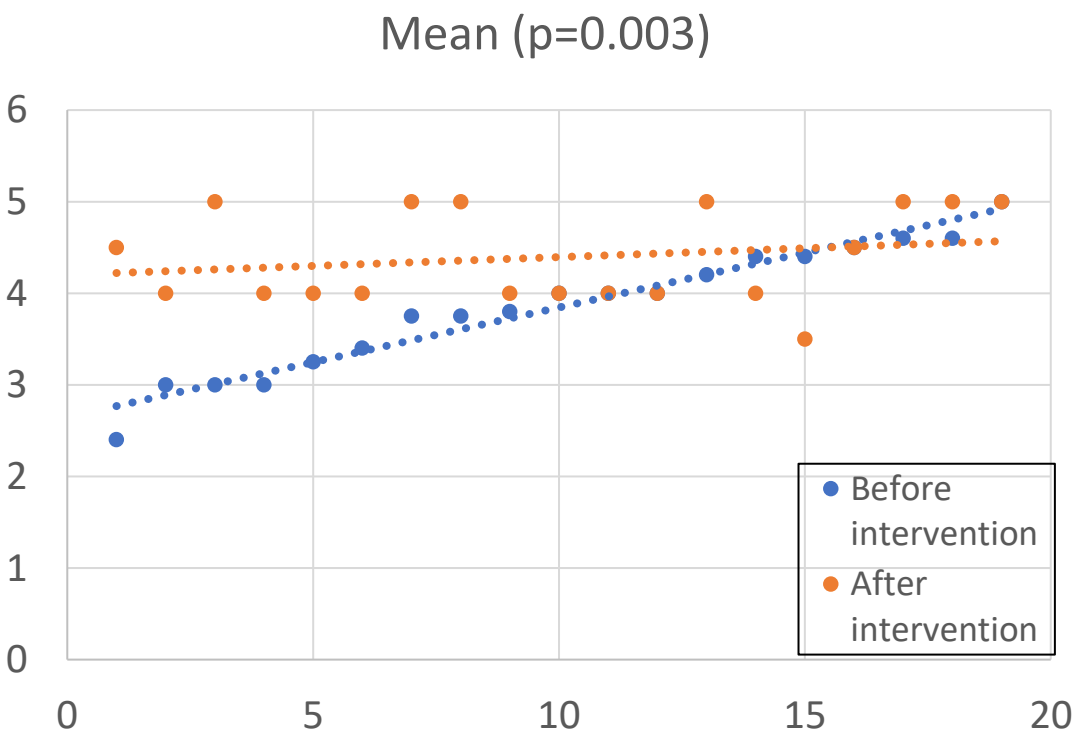
Before intervention
After intervention


Mean (p=0.003)
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Before intervention
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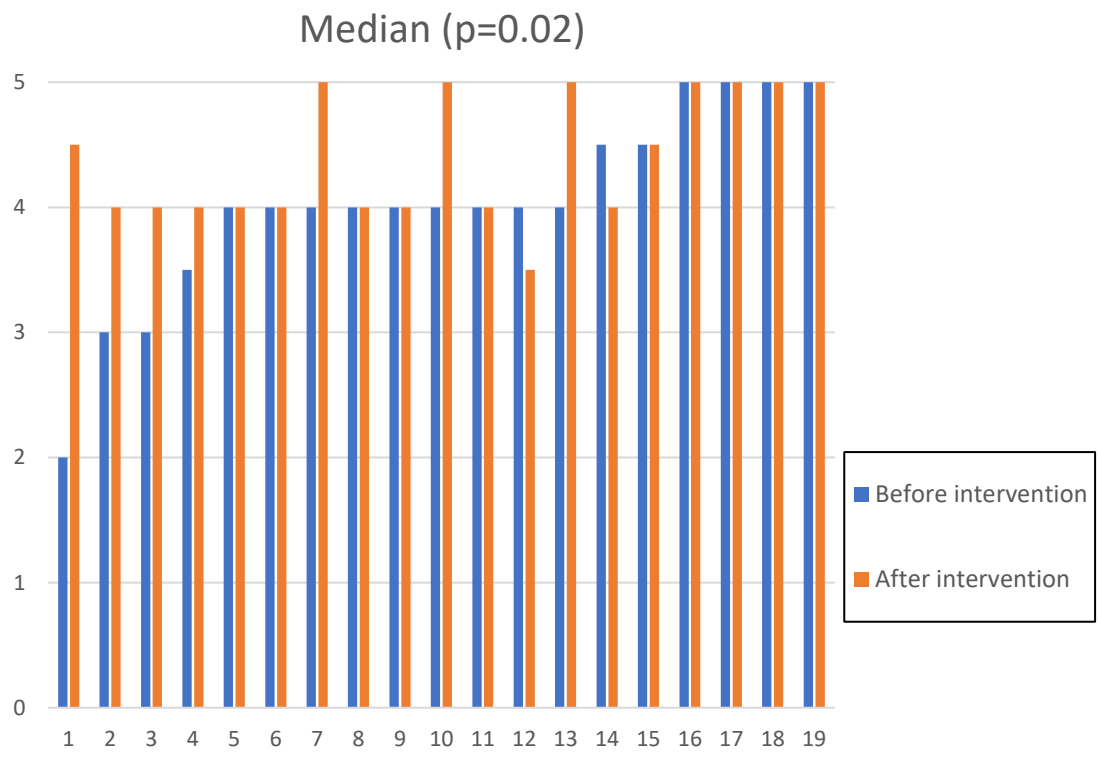

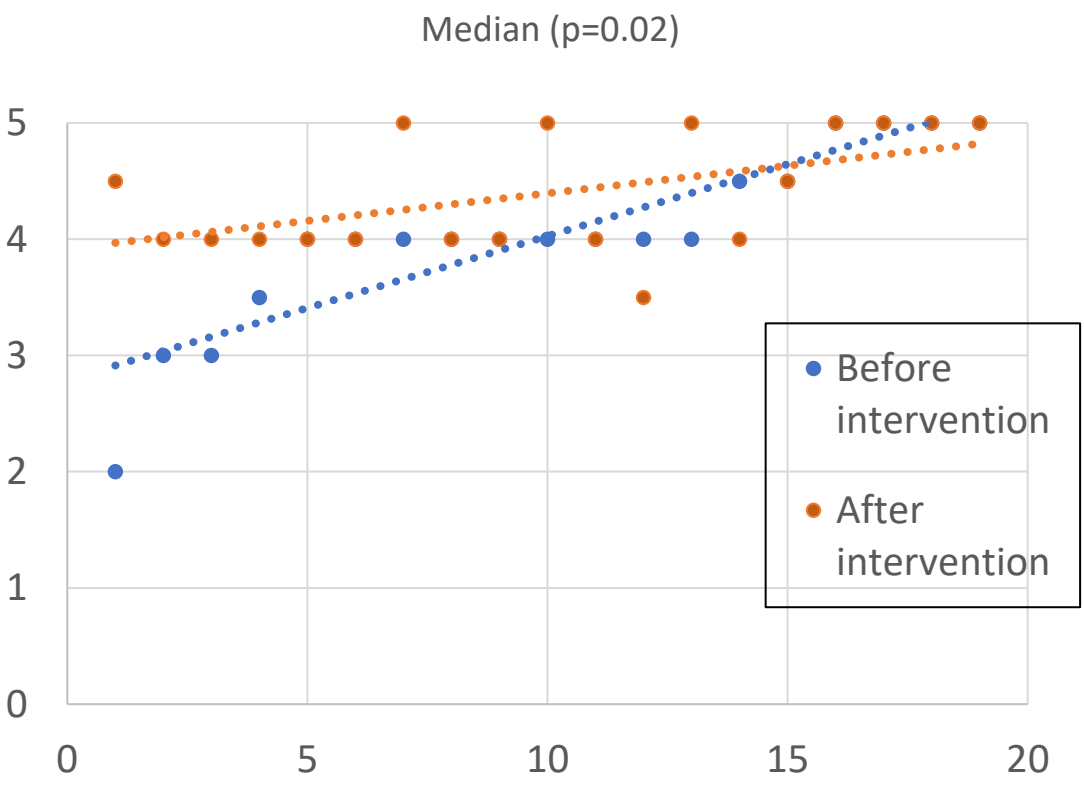

The mean and median showed a significant difference in student scores before intervention and after intervention, with the mean indicating a significant p-value of 0.003 and the median p-value also being significant (p=0.02).

The bar graph and scatter plots for mean and median indicate that before intervention there was a spread of scores ranging from 2.4 to 5 for the mean and a median from 2 to 5. After intervention scores showed a smaller range between 4 and 5 (with one outlier at 3.5).

Discussion and Conclusion

These results suggest that students' scores showed a significant improvement after intervention, with all but one student averaging a passing score (minimum of 4 out of 5). The student who did not have a mean or median of a passing score had only one poor test and so can be regarded as an outlier due to external factors rather than the intervention not being useful for them.

It is apparent that intervention led to improved student results in KO tests as well as application of these terms and definitions in lesson. Overall, the majority of students were passing the KO test. A general gauge of students' enjoyment and preference to use the online platform was discussed and it was clear that students preferred the online platform method to the original read, cover, write method, suggesting that they engaged more actively with the terms and definitions in a different format.

Limitations

Although results overall look promising, there are of course limitations to these data and the study overall. The first limitation is the small sample size with incomplete data. Not only was there only data for 19 students, but throughout the study, there were students who were absent on different days, further reducing the number of data points. In addition to this, data was skewed towards the post intervention tests, with data for 5 tests versus 2 tests. The data was also limited by the fact that the range of possible scores is small, so therefore a difference in a score of 1 results in a difference of 20%. Finally, there is also the confounding factor that students scores may have improved as they knew the scores would be collected as data for a research project, so may have spent more time on learning the definitions which might results in better scores.

Conclusion

In conclusion, the results of this study show that the using an online platform tool for students to learn scientific terminology and definitions is helpful, showing a significant increase in their performance.

Further exploration

The next steps include a second long-term study on a different group of students (possibly in a year group) with potentially roll out of the use of the Carousel platform across the whole school.

References

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