2021 cohort

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What is the impact of using mnemonics to aid knowledge retrieval in a mid-attaining year 8 class?

Introduction

"Please sir call me Alfred Zaccheus in the lab, he can make silver and gold". This is a mnemonic I was taught over 20 years ago, while in secondary school, for the electrochemical series. Due to this mnemonic, I never forgot the order of reactivity of metals. I am sometimes surprised that I still remember the mnemonic.

Mnemonics are techniques used to easily remember information (Putnam, 2015). They are not used as a general teaching strategy but are used as a technique to help students recall information, particularly in information-dense subjects like geography and science (Mastropieri and Scruggs, 1998). There seems to be a controversy in the literature about the use of mnemonics in general in learning. Proponents of using mnemonics have reported that they are highly effective when used correctly (Levin, 1993; Worthen and Hunt, 2011). For example, Çolak and Aydın, 2022 showed that the use of mnemonics was beneficial in helping students retain key knowledge in history. This indeed agrees with over 50 years of research that has proven that mnemonics are well-founded in education (Çolak and Aydın, 2022). Detractors, however, present that they have limited applicability and are not as versatile as other techniques such as retrieval or spaced practice (Dunlosky *et al.*, 2013). Several types of mnemonics have been used in learning: link method; loci method; peg system; keyword method; phonetic system; acronyms; acrostics; and songs, stories, and rhymes (Putnam, 2015; González, Goñi-Artola and Campos, 2021). Of these, acronyms and acrostics are two of the most used in educational practice (Lubin and Polloway, 2016) – this is probably due to their simplicity, making it an easy retrieval strategy among educationists and students.

Although extensive research has been done on the use of mnemonics, few studies exist to show how its use has been particularly beneficial to low/middle-attaining students. This research will focus on whether the use of acronyms or acrostics could help middle-attaining students retrieve powerful knowledge in science. Acronyms are abbreviations in which each letter stands for a keyword. A common example in science is ROYGBIV; Here each letter is the initial letter of each colour that makes up the rainbow. Acrostics are similar in that the initial letter in each word that makes up a sentence represents the initial letter of a keyword. An example is "**R**ichard **O**f **Y**ork **G**ave **B**attle **I**n **V**ain". Here the initial letters serve as a cue to remembering the various colours of the rainbow (Putnam, 2015).

Radović and Manzey, 2019 showed that the use of mnemonic acronyms promotes learning of the procedures involved in a task but give no additional assistance to learning how to execute the task. I agree with this - for example, the acronym for the electromagnetic spectrum would aid retrieval of the various waves that make up the spectrum, but would give no additional benefit in helping students know the properties of the various waves.

I am carrying out this research because students have much key knowledge to learn across many subjects. This might be manageable for high-attaining students; however, some low/middle-attaining students find this overwhelming. A challenge for myself and many of my colleagues is getting these students to recall what they have been previously taught. A common practice is the use of immediate and spaced retrieval to help in knowledge transfer from students' working memory to their long-term memory. This research aims to investigate how the use of mnemonics can make immediate or spaced retrieval less-burdensome for middle-attaining students.

Method

The research involved 28 middle attaining year 8 students. In the first set of investigation, a retrieval of the organs of the human digestive system was done in one lesson a week for a month. Data was taken on how many of the organs each student remembered. In the second set of investigation, the students were given a mnemonic (Figure 1) to help them remember the 8 subcellular structures. They were then required to retrieve the knowledge in one lesson a week for a month. Data was also taken on how many each student remembered. The digestive system and subcellular structures were chosen for this investigation for two reasons:

1. The students had previously learnt them in year 7.
2. Both were foundational to several topics they would later encounter in science.

My - Mitochondria
Nice - Nucleus
Cuddly - Cytoplasm
Red - Ribosomes
Cow – Cell membrane
Chews - Chloroplasts
Crunchy – Cell wall
Vegetables - Vacuole

Figure 1: Mnemonic used for the subcellular structures

Results and Discussion

In the first lesson students were asked to recall the 10 organs of the human digestive system, approximately 24% of them remembered none of the organs, while an approximate 10% of them remembered all the organs (Table 1, Figure 2, 25/11/22). They had last learnt this in year 7, hence the results were not surprising.

Table 1: Results for recalling the organs of the human digestive system without the use of a mnemonic

Date	Total remembered	0	1	2	3	4	5	6	7	8	9	10
25/11/22	Percentage of students who remembered	23.5	4.9	0.0	9.8	5.0	9.8	13.7	9.8	0.0	13.7	9.8
01/12/22	Percentage of students who remembered	8.1	0.0	17.2	8.1	3.9	8.1	0.0	8.1	21.2	0.0	25.3
09/12/22	Percentage of students who remembered	13.0	0.0	0.0	4.0	4.0	4.0	4.0	17.0	25.0	8.0	21.0
15/12/22	Percentage of students who remembered	13.3	0.0	0.0	4.3	4.3	4.3	9.2	4.3	13.3	17.3	30.6

As students consistently retrieved their knowledge of the organs once every week, as expected, the percentage of students who remembered all the organs increased from approximately 10 % in the first week to 31 % in the fourth week, while the percentage of those who remembered none decreased from approximately 24% in the first week to 13% in the fourth week (Table 1, Figure 2, 15/12/22). These results are consistent with numerous research that shows that retrieval practice promote learning (Moreira, Pinto, Starling and Jaeger, 2019).

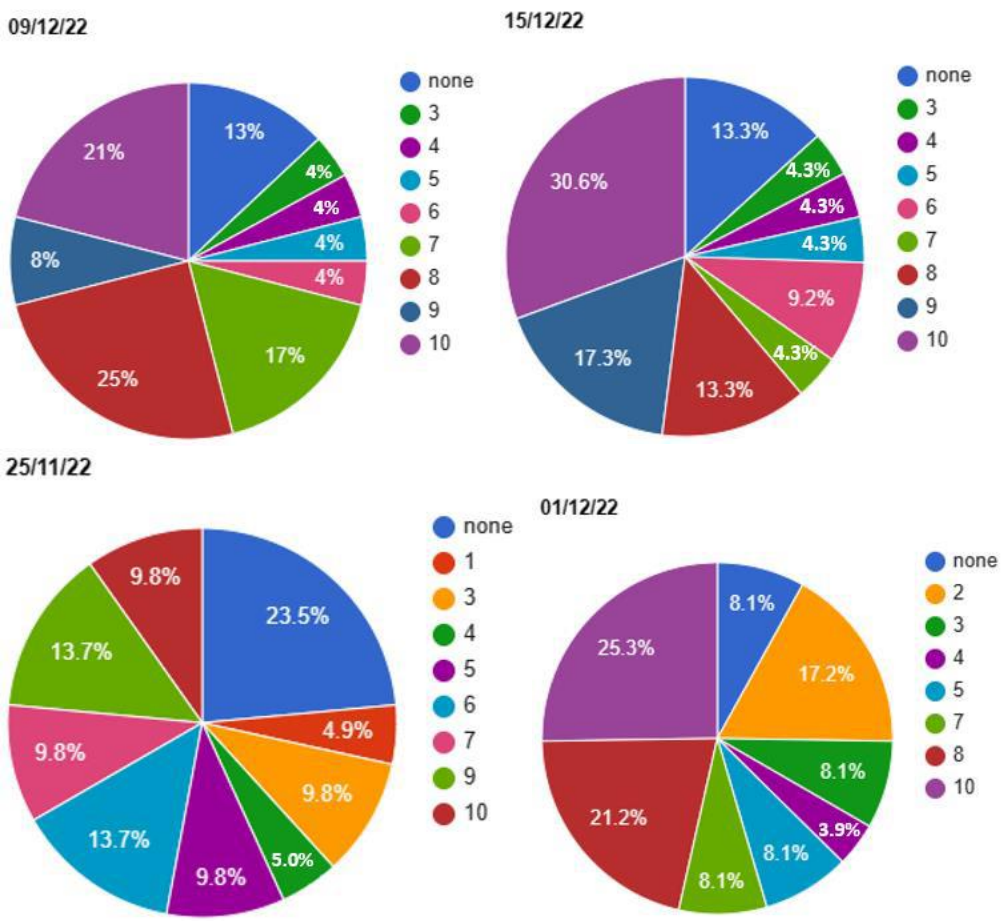

Figure 2: Pie chart presenting retrieval percentage without a mnemonic

In another lesson (Table 2, Figure 3, 30/03/23), students were asked to retrieve the 8 subcellular structures. Approximately 13 % remembered 4 out of the 8 subcellular structures, whilst another 13 % remembered the entire 8. No student remembered none. A Mnemonic (Figure 1) was then given to them to aid retrieval (Mastropieri and Scruggs, 1998).

Table 2: Results for recalling the subcellular structures with the use of a mnemonic

Date	Total remembered	0	1	2	3	4	5	6	7	8
30/03/23	Percentage of students who remembered	0.0	0.0	0.0	0.0	13.3	33.3	40.0	6.7	13.3
21/04/23	Percentage of students who remembered	0.0	0.0	0.0	0.0	5.3	5.3	5.3	21.0	63.1
05/05/23	Percentage of students who remembered	0.0	0.0	0.0	0.0	0.0	0.0	4.0	12.0	84.0
21/06/23	Percentage of students who remembered	0.0	4.3	0.0	0.0	0.0	0.0	4.3	4.3	87.1

Remarkably, 3 weeks later, 63 % of them remembered all the subcellular structures (Table 2, Figure 3, 21/04/23). In another 2 weeks, the number of students who remembered all increased from 63 % to 84 % (Table 2, Figure 3, 05/05/23). Finally, more than a month later, 87 % of the students were still able to recall all 8 subcellular structures (Table 2, Figure 3, 21/06/23). These results corroborate research by Radović and Manzey, 2019 that showed that mnemonics have some benefits in aiding knowledge retrieval.

Figure 3: Pie chart presenting retrieval percentage with a mnemonic.

The results of this study show that mnemonics could be a useful tool in aiding knowledge retrieval. There are however some limitations to this study. The use of different key knowledge for both sets of investigation – students might have found it easier to recall the subcellular structure even without a mnemonic. Another limitation is that the students in the subject class changed during the cause of the study, resulting in different sets of students being used for the different sets of investigations. These limitations, however do not expunge mnemonics as a useful retrieval tool.

References

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