TAPPING INTO PERSONAL GENIUS: THE EFFECT OF APPLYING SELF
KNOWLEDGE OF MULTIPLE INTELLIGENCES AND PREFERRED LEARNING
STYLES ON STUDENT SUCCESS IN HIGH SCHOOL PHYSICS

by
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STATEMENT OF PERMISSION TO USE

In presenting this professional paper in partial fulfillment of the requirements for a master’s degree at Montana State University, I agree that the MSSE Program shall make it available to borrowers under rules of the program.

Lance Scot Gerow

July 2013
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ABSTRACT

This study examined students’ use of assessment tools to provide an indication of their relative multiple intelligences and preferred learning styles. Using this information, students chose study and revision methods best suited to their personal strengths and preferences to assist with physics concept internalization and employed them during a unit of study. Results indicate that performance and attitude toward physics improved.
INTRODUCTION AND BACKGROUND

In September of 2012 I moved to and began teaching in Riyadh, the capital of Saudi Arabia. Riyadh is one of the most rapidly growing cities in the world with a current population of close to 6 million people (Riyadh, 2013). My school, the British International School Riyadh (BISR), was opened in the 1979 to provide educational opportunities to the children of expats living in Riyadh (British International School, Riyadh, 2009). There were 212 students enrolled at that time and the population of Riyadh at was less than 800,000. The school itself has grown from humble beginnings to its current size of over 1400 students, of whom 522 are in grades 6-12. BISR is committed to maintaining at least 50% British students and currently has 57% British enrollment. There are currently 42 nationalities represented at the school with an approximately equal gender ratio. For a variety of reasons, many of the British students opt to leave the school after grade 8 or grade 10 and complete their schooling in the U.K. This means that there is a much higher ratio of international, primarily Arab, Indian and Pakistani, students in the higher grades. Very few Saudi students attend the school (M. Steele, personal communication, March 2013).

There are some fundamental differences in how the British education system is structured compared to the American system. During grades 9 and 10 (known as years 10 and 11 in the British system) students take selected courses toward a General Certificate in Secondary Education (GCSE). After successful completion of GCSE, students select advanced level courses, known as A-levels, for study during their final two years of secondary school. Grades for these courses are determined primarily from end of course or module external exams. Some internally assessed work may make up a component of
the grade, such as practical work in the sciences, but even these include an externally prepared exam. Unlike most American schools, where quizzes and tests make up a portion of the student's grade, all of the assessment done in GCSE and A-level courses is designed to prepare students for a successful result on their final external exams.

This difference in structure results in some fundamental differences in how students approach their learning. One such difference is evident when reviewing the results of a test with a class. The questions asked by students are most often related to better understanding what is required for full marks and seldom involves students pleading their case for more marks. Students know that the scores on internal tests do not decide their future, so view them as practice for the exam that does count. While it is certainly nice to have students keen to improve, such a system also has a down side in that students often put insufficient effort into quizzes or tests because they see them as having no value to them. The school year is structured in such a way that students have several weeks of revision time during which they focus entirely on exam preparation. As a result, some students put in little effort during the term and then try to learn the full course in the weeks leading up to the exam.

There is also a significant Arab influence on how students at BISR approach their studies. Historically, education in the Arab world has been influenced by the teachings of Islam and has focused on reading and repetition. Memorizing long passages from the Holy Quran has long been held in high regard. As a result, many students apply this approach when studying the sciences.

Physics is not a subject that lends itself well to memorization. Rather, students who are successful in physics tend to be those who fully grasp the fundamental concepts
and can apply this knowledge to new and challenging situations. It is this situation that inspired my research and led to my focus question, What is the effect of applying self-knowledge of one's multiple intelligences and learning styles on student success in high school physics? The sub-questions related to the study include the following:

- Does self-selection of revision strategies based on dominant intelligences or preferred learning styles lead to improved performance on standard tests?
- What is the effect on student attitudes toward physics?
- What is the effect on student attitudes toward revision?

CONCEPTUAL FRAMEWORK

Dr. Howard Gardner, a professor of education at Harvard University, changed the way intelligence is viewed by introducing the idea of multiple intelligences. At that time Gardner identified seven intelligences. They include the following:

- linguistic intelligence (word smart)
- musical intelligence (music smart)
- logical-mathematical intelligence (number/reasoning smart)
- spatial intelligence (picture smart)
- bodily-kinesthetic intelligence (body smart)
- interpersonal intelligence (people smart)
- intrapersonal intelligence (self smart)

Since that time he has also added naturalist intelligence (nature smart). Even more intelligences have been suggested more recently such as existential and emotional. For the purpose of our discussion we will limit ourselves to the eight listed above. Gardner's
theory of multiple intelligences (MI theory) became a lightning rod for new approaches to teaching and learning in education. No longer was intelligence viewed as a singular quantity measurable by an I.Q. test. Gardner essentially provided a way to identify the many different ways in which one can be considered smart.

It is important to make a distinction between multiple intelligences (MI) and learning styles (LS). The term learning styles refers to qualitative differences among individual students' habits, preferences or orientation toward learning and studying (Reiff 1992, Messick 1994, Sternberg 1997), whereas Gardner (1999) defines intelligence as “a biopsychological potential to process information that can be activated in a cultural setting to solve problems or create products that are of value in a culture” (p. 33). One might choose to think of a learning style as a preferred method of data input into the computer that is the human brain, while intelligences are the relative abilities of that brain to process the data.

Learning styles can be divided into different modalities. The three most commonly referred to are visual, aural and kinesthetic. When one takes in information they do so either with their eyes, through their ears or by touching or otherwise physically interacting. It has been suggested that students will learn best when taught through their preferred modalities (Barbe & Milone 1980).

Both MI and LS theory have received considerable attention and criticism. A common misinterpretation of LS theory has been that a student's preferred modality is the only way they learn. Rohrer and Pashler (2012) found, "there presently is no empirical justification for tailoring instruction to students' supposedly different learning styles. Educators should instead focus on developing the most effective and coherent ways to
present particular bodies of content" (p. 635). MI theory has often been confused with learning styles. One must remember that LS is the way in which we take in information while MI is the way(s) in which we process it. Chan (2006) suggests that, "teachers and parents could be made more sensitive to students' profiles and become more aware of students' well developed, as well as less developed, intelligences" (p. 325). One could add that, once a student has reached an appropriate age, they too should be made more sensitive to their own profile so that they can better understand how they best take in and process information. Silver, Strong and Perini (1997) encouraged educators to, "help students discover their unique profiles, as well as a balance of styles" (p. 23). Offering students a choice of activities from which they select those they feel best suit their preferred modality is known as negotiated self-direction (Klein 2003, p. 47).

Once a student has accurately assessed their preferred learning styles and relative multiple intelligences, the question is one of priorities. They may choose to focus on further developing their areas of strength, thereby enhancing their genius, or work at minimizing their deficiencies by addressing their areas of weakness. I suggest that a successful revision strategy strikes a balance between the two. By way of analogy, consider David Beckham. In the prime of his career, David Beckham was considered one of the elite footballers in the world. His most notable gift on the soccer field was his ability to strike the ball with great power and accuracy with his right foot. School children throughout the world wanted to be able to 'bend it like Beckham'. Clearly, this was his genius. However, this is only one facet of the game and one does not reach the very heights in their field if they are one-dimensional in the abilities. While it is certain that Beckham has spent countless hours practicing his free kicks in an effort to perfect his
gift, he has also trained for all aspects of the game, especially the weakest aspects of his game. All elite athletes face this and an excellent student would do well to model their behavior after elite athletes.

METHODOLOGY

My intention in designing my methodology was not to try to tailor instruction to a particular learning style. I tried to do what most teachers do, and that is teach using all modalities (verbal, aural, kinesthetic) in order to communicate as clearly and completely as possible the concepts or a particular topic. What I did try to change was the students' awareness of their own preferred learning style(s) and their relative multiple intelligences. I then encouraged them to search for study strategies that worked best for them in light of this information. Throughout the process I regularly reminded them that no person has a single way to learn and process and that they must strive for a balanced approach to learning.

I chose my year 10 physics class as my treatment group. Students in this grade are required to take at least one science as part of the GCSE program. This course is divided into three units, each of which has an external exam. Of the 86 students registered in ninth grade at BISR during the 2012-13 school year, 35 chose to study physics as an individual subject. Many of these students registered in all three sciences, but there were a few who chose to take physics as their only science. This means that many of these 35 students have an interest in continuing their education in a scientific field, but a few likely have no intention of further study in physics. The 35 students are divided into two cohorts, 18 were taught by me and the other 17 by my colleague. These two groups
served as the treatment and non-treatment groups for my study. The topics covered during the treatment period were Motion and Forces, which are the first two topics of the second unit of study.

Before beginning their study of Motion and Forces students from both classes were given a Motion and Forces Topic Test (Appendix A) consisting of questions selected from past external exam papers. This test consisted of four questions totaling 24 marks and time was limited to 24 minutes. Each mark awarded was categorized by component and by topic. The three components identified were knowledge and understanding (KU); application, analysis and evaluation (AAE); and calculation (C). Questions labeled as KU required recall of factual information or an explanation of a concept. AAE questions were those for which students needed to apply their knowledge to a particular situation. Any questions requiring a calculation were categorized as C. The topics used for categorization were motion and forces.

Students were also given a Force and Motion Conceptual Evaluation (FMCE, Appendix B) and were given as much time as needed to answer as many of the 43 questions as they could. This instrument is designed to uncover student misconceptions related to forces and motion with a particular focus on graphs showing distance-time, velocity-time, acceleration-time and force-time. Students were instructed to answer only the questions they thought they knew and otherwise to leave questions blank. The number of correct responses out of 43 was recorded as well as a percentage score and an average score was calculated for each group. The difference between pretreatment and posttreatment assessments was determined and the improvement by the two groups was compared.
Both classes also completed a Student Survey designed to gauge how they studied physics and their attitude toward the subject (Appendix C). Each of these instruments was repeated posttreatment. An average Likert scale score was calculated for each group pre and posttreatment and compared to see if any change or trends occurred.

Due to several absences only 16 out of 18 students in the treatment group and 11 out of 17 in the nontreatment group completed both the pretreatment and posttreatment assessments. Only the data from these students was used to measure improvement during their study of the Motion and Forces topics of study. I calculated posttreatment minus pretreatment for each student to determine the percentage difference and then averaged this value for each class. The difference in average improvement values between groups was taken to be the value added by the treatment. Survey data was taken on the aggregate for each group so all submissions were used for analysis, including students who did not complete the survey at pretreatment and posttreatment. I also compared the two groups using baseline test data from the Centre for Evaluation and Monitoring (CEM) at Durham University. All students write the Year 11 Information System (Yellis) test that is intended to provide a predicted grade based on student ability. However, only 11 out of 18 students in my class wrote this test and only 3 out of 17 in the non-treatment group, so any comparisons from this data were not statistically valid. Individual scores were compared to test results to see if the topic test and FMCE correlated with Yellis data in order to get a sense of the validity of the tests used. There appeared to be a correlation between these instruments.

Pretreatment data collection was completed in one day. The next day, students were given a link to an online multiple intelligences assessment tool, the Birmingham
Grid for Learning (BGfL), and were asked to complete the survey at home (Birmingham Grid for Learning, 2002). After completing the survey, the BGfL creates a chart indicating one's relative strength in each of the 8 intelligence areas (Appendix D). They were asked to take a screen shot of this chart and email it to me. They were also asked to take note of which areas they were particularly strong in. In addition, a short Learning Styles Inventory was given to help students identify their preferred learning styles as visual, aural or kinesthetic (Appendix E).

At the beginning of the next class we discussed the different intelligence areas and students were asked to suggest how someone with a particular intelligence might learn best. This topic was revisited over the next three lessons, simply as a way of identifying and reinforcing the variety of ways in which one learns. After three lessons the objectives of the Motion chapter had been covered and students were given a number of revision methods based on various intelligences or learning styles (Appendix F). Each student was asked to select one or more methods based on what they felt was their predominant intelligence and to use this method when revising their study of Motion and Forces. In the following lesson students were shown a Powerpoint presentation (Appendix G), which outlined various revision techniques and who they may be best suited to. For some students this information helped reaffirm their commitment to their selected method while others adapted their method based on what they learned from the presentation.

Over the next 12 lessons (4 weeks) students covered the content of the Forces chapter. Students were now becoming adept at identifying the ways in which different intelligences may benefit from the various activities. At the end of this topic students
were given the same topic test and FMCE. They did not know the test would be identical to the pretreatment assessments. The questions in the topic test were identified by component and by subtopic. The components the questions were classified as were: knowledge and understanding; analysis, application and evaluation; and calculation. The subtopics identified were motion and forces. Both the treatment and non-treatment groups also repeated the online survey. This survey included additional questions asking about the perceived effectiveness of any new revision strategies attempted. Lastly, a random selection of five students were interviewed (Appendix H) to get a sense of what effect, if any, the treatment had made on their approach and attitude toward their studies. The plan to have a delayed assessment was scuttled by an external exam on previous material that the students needed to revise for.

A summary of the data collection instruments can be found in the triangulation matrix in Table 1.
Table 1  
*Triangulation Matrix*

<table>
<thead>
<tr>
<th>Focus Questions</th>
<th>Data Source 1</th>
<th>Data Source 2</th>
<th>Data Source 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Does self-selection of revision strategies based on dominant intelligences or preferred learning styles lead to improved performance on standard tests?</em></td>
<td>Compare Motion and Forces Topic Test results from pre to posttreatment between treatment and control groups</td>
<td>Compare FMCE results from pre to posttreatment between treatment and control groups</td>
<td>Comparison of average scores before and after treatment</td>
</tr>
<tr>
<td><em>What is the effect on student attitudes toward Physics?</em></td>
<td>Pre and posttreatment surveys</td>
<td>Student interviews</td>
<td>Instructor observations and journalling</td>
</tr>
<tr>
<td><em>What is the effect on student attitudes toward revision?</em></td>
<td>Pre and posttreatment surveys</td>
<td>Student interviews</td>
<td>Instructor observations and journalling</td>
</tr>
</tbody>
</table>

**DATA AND ANALYSIS**

The data from the MI and LS inventories reflected the general feeling I had about the class. They were a very social bunch who loved discussion and activities. How one processes the data from such inventories can affect the interpretation of the data. Let us first consider the data from the MI inventory. I first viewed the average score for each intelligence (Figure 1) and found that all scores were relatively high, though interpersonal was rated highest.
Figure 1. Average intelligence self-ratings by students ($N = 18$).

I then looked only at the highest score for each student (Figure 2). This was taken to be their predominant intelligence. Most students had a second intelligence within three points of their highest ranking, which is not reflected in this figure. Once again interpersonal is the dominant intelligence. However, in this form one is given the impression that linguistic and naturalistic intelligences are not prevalent in this group, which is not the case and can be misleading. For example, visual/spatial intelligence barely registers when we look only at the top rated intelligences, and this is not representative of the other methods of analysis.
Lastly, I considered both the highest rated intelligence as well as any other intelligence that received a score within three points of the highest for each student. The highest was given a point value of two and the others a point value of one. While the point values are arbitrary the intention is to represent the primary and secondary intelligences identified by the BGfL data with additional weight given to the highest rated intelligences. The results are seen in Figure 3.

*Figure 2. Predominant intelligence self-ratings by students (N = 18).*
In all cases one can clearly see that this group of students identify themselves primarily as interpersonal as their predominant intelligence. This should indicate that they will prefer to discuss concepts with each other and work collectively as they revise. The danger of such data is that it can lead one to think all students fit this profile. One particular student indicated that they found the noise level in the class very distracting when they were trying to revise. They needed a quiet place where they could write summary notes and reflect on the material. When this was brought up it was agreed that this student could work at the tables outside the room during revision time. They were close enough that I could check on them but far enough so as not to be distracted by the others. Others were given permission to listen to music when they studied, provided they
could explain how it would help them. One student indicated that they listened to the same music whenever they studied this topic, so that they could associate the music with the material. Yet another student was happy to sit on his own in the corner and create a set of flashcards (considerable in number), which they often used afterwards. They could be seen rewriting cards when they were not quite right. This student also, coincidentally, showed the greatest improvement on the topic test. He identified himself as being predominantly kinesthetic in intelligence, though his preferred learning style was verbal. He loved to handle the flashcards and even drew an animation on the corners that showed movement as he flipped them quickly.

The LS inventory was given similar treatment and once again supported my initial impression of this group. The average scores from the LS inventory shows a group preference for kinesthetic and a slight preference for visual or aural (Figure 4).

![Figure 4. Average self-rating of learning style (N = 18).](image)

Of course we all take in information through all three modalities, so knowing which is the preferred learning style provides the more telling information about this group (Figure 5). A majority of this group feels that they learn best kinesthetically.
Figure 5. Predominant learning style, self-rated, (N = 18).

The results of the topic test were analyzed by component, subtopic and overall averages and a comparison was made between the treatment and nontreatment groups. Any additional improvement by the treatment group was identified as possible value added. There was no real difference of note between the results from the two groups on the Motion and Forces Topic Test (Table 2). The treatment group showed greater improvement on the motion topic and on calculation problems, while the nontreatment group improved more on the forces topic and on knowledge and understanding questions. This could be attributed to the different teaching styles of the two teachers or the activities they chose for these topics, which were not controlled. The teacher of the nontreatment group is more familiar with the course syllabus and the types of questions posed by the exam board and makes a pointed effort to teach to these points. This might explain their better performance on knowledge questions.
Table 2
*Motion & Forces Topic Test - average results*

<table>
<thead>
<tr>
<th>Group</th>
<th>Pretreatment (%)</th>
<th>Posttreatment (%)</th>
<th>Improvement (%)</th>
<th>Value Added (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment (N = 16)</td>
<td>53.6</td>
<td>69.0</td>
<td>15.4</td>
<td>0.6</td>
</tr>
<tr>
<td>Nontreatment (N = 11)</td>
<td>56.8</td>
<td>71.6</td>
<td>14.8</td>
<td></td>
</tr>
</tbody>
</table>

The Force and Motion Concept Evaluation (FMCE) showed more of a difference (Table 3). The first difference was just how poorly both groups scored, even after studying the topic. The highest score on the FMCE was 15/43 (35%). This test is designed to uncover misconceptions and past experience with older students yielded similar results. Although the scores were low, the improvement by the treatment group was more than 3.5 times that of the non-treatment group, so it would appear that some value was added here. There is not, however, sufficient data to attribute causality. It is possible that my familiarity with the FMCE affected how I taught the topic and so influenced the results.

Table 3
*Force and Motion Conceptual Evaluation - Average Results*

<table>
<thead>
<tr>
<th>Group</th>
<th>Pretreatment (%)</th>
<th>Posttreatment (%)</th>
<th>Improvement (%)</th>
<th>Value Added (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment (N = 16)</td>
<td>12.1</td>
<td>20.3</td>
<td>8.2</td>
<td>6.1</td>
</tr>
<tr>
<td>Nontreatment (N = 11)</td>
<td>10.8</td>
<td>12.9</td>
<td>2.1</td>
<td></td>
</tr>
</tbody>
</table>

The Student Survey completed by both groups before and after the topic showed no considerable pattern of change over time or between groups. Both groups indicated
that they found the changes they made to how they studied effective, which is ironic because only the treatment group was asked to make any changes. The nontreatment group actually indicated that they felt better prepared for tests than the treatment group. This may be due to the nature of the external tests they sit and the fact that their teacher prepares them very well for these tests. It is open for debate whether this is the same as preparing them for further study in the subject or fully grasping the concepts. Changes in average Likert scale responses between the two surveys can be seen in Table 4. Color-coding has been used in an attempt to make the data more clear. A decrease in score on a negative question or an increase on a positive question is a good thing and so is shown in green. The converse is shown in red. The data would appear to indicate that students in the treatment group, over the course of the treatment, found physics less difficult and less challenging, and felt more comfortable about how to improve their performance. They also felt less prepared for tests and enjoyed physics less. This was in complete contrast to the nontreatment group in every aspect. Questions 3 and 4 may be related in that, if a student knows how to improve their performance and feels empowered by this knowledge, they may recognize that it is their job and not the job of the teacher to prepare them for tests. It is also possible that I was too focused on the research aspects of the topic and did not do as good a job as usual in preparing them for the test.
Table 4
*Change in Average Likert scores. Green is a Positive Change, Red is Negative*

<table>
<thead>
<tr>
<th>Statement</th>
<th>Change by Group</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Treatment</td>
<td>Nontreatment</td>
</tr>
<tr>
<td>2 - Physics is difficult for me.</td>
<td>0.26</td>
<td>0.75</td>
</tr>
<tr>
<td>3 - I don't know how to improve my performance in Physics.</td>
<td>0.42</td>
<td>0.33</td>
</tr>
<tr>
<td>4 - The teacher prepares the class adequately for tests.</td>
<td>0.53</td>
<td>0.83</td>
</tr>
<tr>
<td>5 - The study strategies I use prepare me adequately for tests.</td>
<td>0.11</td>
<td>1.08</td>
</tr>
<tr>
<td>9 - I find Physics challenging.</td>
<td>0.63</td>
<td>1.33</td>
</tr>
<tr>
<td>10 - I enjoy Physics class.</td>
<td>0.53</td>
<td>1.00</td>
</tr>
</tbody>
</table>

The interviews told a very different story from what I was able to surmise from the tests and surveys. Of the five students surveyed, all five indicated overwhelmingly that the experience had been a positive one. Four of five said they had changed the way they approach studying not only for physics but for all of their subjects. All students surveyed could recall not only what their predominant intelligence was but could explain why the methods they used were well suited to them. One student said, "it has made me a lot clearer about what kind of strategies I should use" and that, "it made me understand myself a lot better". Many students indicated that their default method of revision in the past was to read the textbook and possibly write down some key terms. A second student indicated that, "before I used to just read the textbook but that just didn't cut it so I tried various different methods". When describing how their methods of choice helped them, this student explained, "I kind of interact with my work so it stays in my head for longer".
This particular student had been attained mediocre results up until this treatment began and the change it brought about in them was astounding. I feared they might think that they had found the magic formula for success and expected to hear as much when I asked about any planned changes for the future. I was surprised and delighted when they said they were, "thinking of, during the summer, to play around with the strategies to see if they have a better impact to what I'm doing now". One of the weakest students in class, conversely, was very sure about how they learned and was not open to the idea of trying new methods.

My personal observations during the treatment were that students gradually became open to new ideas. Some required more prompting than others and had to be encouraged to try something new 'just for this topic'. My optimism waned somewhat when I viewed the test results but the interviews restored my faith in the process.

INTERPRETATION AND CONCLUSION

The data collected from tests and surveys does not indicate any considerable change as a result of the treatment and is not sufficient to make any claims about the effect of the treatment. There was no change in performance on standardized tests, though some improvement was noted in their conception (via the FMCE). Attitudes toward physics as a subject also showed no significant change. There was some indication that attitudes toward revision improved. This is to be expected with a small sample size and only 12 weeks for a treatment period. However, there are indications from the surveys and particularly from the interviews and teacher observations that would suggest that providing students with information about the different ways in which we
take in and process information can be a very valuable step in helping each student recognize study strategies that may be best for them. Even more so, it can help them to learn who they are as a learner. This is good knowledge for students to have and should not be viewed as fixed or absolute. Students will have many different teachers during their lives and it is not reasonable to expect the teacher to tailor all instruction to fit the learner profile of each student. A student who knows their own strengths and weaknesses can utilize their strengths when needed, develop their weaknesses over time, and adjust to almost any teaching environment.

Such information can also be a powerful ally when trying to overcome cultural norms pertaining to learning and education. Many of my students have been raised with the ethos that revision means reading and repeating. Such methods are effective for general recall but do not lend themselves to durable concept development. Changing norms that are culturally based can be very difficult but can happen in a single generation if the next generation becomes disenchanted with the status quo. Gaining insight into how one's brain works and adopting strategies to accommodate for this information has the potential to bring about such a change.

VALUE

Much research has focused on how to change the way one teaches so as to take into consideration multiple intelligences or learning styles. My focus has been to put these tools in the hands of my students and ask them to use them to make the most out of their classes, my subject as well as others. In that regard I believe my research was a success. The greatest testament one can offer to the value of this treatment is that every
student suggested that I repeat this with classes in future and further suggested that it be provided at the beginning of the year so as to maximize the impact.

One way in which this has changed me as a teacher is that I now look at my students in a different light. Yes, I wonder about their relative intelligences and preferred learning styles, but more importantly I want to put this information into their hands and teach them how to make the most of it. In the coming school year I hope to put a program into place in my school whereby we introduce these theories to students and give them time to identify who they are as a learner and how to use that information. My proposal will be to have a progressive plan from grades 6-12 that develops these ideas and builds a personal intelligence portfolio for each student.

This has also been rejuvenating for me as a teacher as it supports a long held philosophy of mine; that we prepare students for success at the next level, not just the next test. By providing my students with this information and strategies I feel I am equipping them to be successful life long learners.
REFERENCES CITED


APPENDICES
APPENDIX A:

MOTION & FORCES TOPIC TEST
Q1. (a) The diagram shows the horizontal forces acting on a car travelling along a straight road.

\[ \text{Force diagram with 500N and 2000N forces} \]

(i) Calculate the size of the resultant force acting on the car.
Show clearly how you work out your answer.

\[
\begin{align*}
\text{Resultant force} &= \quad \text{N} \\
\end{align*}
\]

(ii) Describe the motion of the car when the forces shown in the diagram act on it.

\[
\begin{align*}
\end{align*}
\]

(b) A car driver makes an emergency stop.

The chart shows the 'thinking distance' and the 'braking distance' needed to stop the car.

\[ \text{Chart with thinking distance 9m and braking distance 14m} \]

(i) Calculate the total stopping distance of the car.

\[
\begin{align*}
\text{Stopping distance} &= \quad \text{m} \\
\end{align*}
\]
(ii) The graph shows that speed affects thinking distance.

Use the graph to find the thinking distance for a car driven at 30 m/s.

Thinking distance = ........................................ m

(i)

(iii) Give one further factor that will affect the thinking distance.

____________________________________________________________________________________ (1)

(Total 7 marks)

Q2. A horse and rider take part in a long distance race. The graph shows how far the horse and rider travel during the race.

(a) What was the distance of the race?

Distance = ........................................ km

(1)
(b) How long did it take the horse and rider to complete the race?

........................................................................................................................................

(1)

(c) What distance did the horse and rider travel in the first 2 hours of the race?

distance = ................................................................. km

(1)

(d) How long did the horse and rider stop and rest during the race?

........................................................................................................................................

(1)

(e) Not counting the time it was resting, between which two points was the horse moving the slowest?

........................................ and ........................................

Give a reason for your answer.

........................................................................................................................................

(2)

(Total 6 marks)

Q3. (a) The diagram shows a steel ball-bearing falling through a tube of oil. The forces, L and M, act on the ball-bearing.

What causes force L?

........................................................................................................................................

(1)
(b) The distance–time graph represents the motion of the ball-bearing as it falls through the oil.

(i) Explain, in terms of the forces, L and M, why the ball-bearing accelerates at first but then falls at constant speed.

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(iii) Calculate the constant speed reached by the ball-bearing.

Show clearly how you use the graph to work out your answer.

\[
\text{Speed} = \ldots \text{m/s}
\]

(2) (Total 7 marks)

Q4. A car is driven along a straight road. The graph shows how the velocity of the car changes during part of the journey.

(a) Use the graph to calculate the deceleration of the car between 6 and 9 seconds.

Show clearly how you work out your answer and give the unit.

\[
\text{Deceleration} = \ldots 
\]

(3)

(b) At what time did the car change direction?

\[
\ldots \text{seconds}
\]

(1) (Total 4 marks)
APPENDIX B:

FORCE AND MOTION CONCEPTUAL EVALUATION

(FMCE)
Force and Motion Conceptual Evaluation

A sled on ice moves in the ways described in questions 1-7 below. Friction is so small that it can be ignored. A person wearing spiked shoes standing on the ice can apply a force to the sled and push it along the ice. Choose the one force (A through G) which would keep the sled moving as described in each statement below.

You may use a choice more than once or not at all but choose only one answer for each blank. If you think that none is correct, answer choice J.

1. Which force would keep the sled moving toward the right and speeding up at a steady rate (constant acceleration)?

2. Which force would keep the sled moving toward the right at a steady (constant) velocity?

3. The sled is moving toward the right. Which force would slow it down at a steady rate (constant acceleration)?

4. Which force would keep the sled moving toward the left and speeding up at a steady rate (constant acceleration)?

5. The sled was started from rest and pushed until it reached a steady (constant) velocity toward the right. Which force would keep the sled moving at this velocity?

6. The sled is slowing down at a steady rate and has an acceleration to the right. Which force would account for this motion?

7. The sled is moving toward the left. Which force would slow it down at a steady rate (constant acceleration)?

Questions 8-10 refer to a toy car which is given a quick push so that it rolls up an inclined ramp. After it is released, it rolls up, reaches its highest point and rolls back down again. Friction is so small it can be ignored.

Use one of the following choices (A through G) to indicate the net force acting on the car for each of the cases described below. Answer choice J if you think that none is correct.
8. The car is moving up the ramp after it is released.
9. The car is at its highest point.
10. The car is moving down the ramp.

Questions 11-13 refer to a coin which is tossed straight up into the air. After it is released, it moves upward, reaches its highest point, and falls back down again. Use one of the following choices (A through G) to indicate the force acting on the coin for each of the cases described below. Answer choice J if you think that none is correct. Ignore any effects of air resistance.

A. The force is down and constant.
B. The force is down and increasing
C. The force is down and decreasing
D. The force is zero
E. The force is up and constant.
F. The force is up and increasing
G. The force is up and decreasing

11. The coin is moving upward after it is released.
12. The coin is at its highest point.
13. The coin is moving downward.

Questions 14-21 refer to a toy car which can move to the right or left along a horizontal line (the positive part of the distance axis). Assume that friction is so small that it can be ignored.

A force is applied to the car. Choose the one force graph (A through H) for each statement below which could allow the described motion of the car to continue. You may use a choice more than once or not at all. If you think that none is correct, answer choice J.

14. The car moves toward the right (away from the origin) with a steady (constant) velocity.
15. The car is at rest.
16. The car moves toward the right and is speeding up at a steady rate (constant acceleration).
17. The car moves toward the left (toward the origin) with a steady (constant) velocity.
18. The car moves toward the right and is slowing down at a steady rate (constant acceleration).
19. The car moves toward the left and is speeding up at a steady rate (constant acceleration).
20. The car moves toward the right, speeds up and then slows down.
21. The car was pushed toward the right and then released. Which graph describes the force after the car is released.

22-26 refer to a toy car which can move to the right or left on a horizontal surface along a straight line (the + distance axis). The positive direction is to the right.
Different motions of the car are described below. Choose the letter (A to G) of the acceleration time graph which corresponds to the motion of the car described in each statement.

You may use a choice more than once or not at all. If you think that none is correct, answer choice J.

22. The car moves toward the right (away from the origin), speeding up at a steady rate.
23. The car moves toward the right, slowing down at a steady rate.
24. The car moves toward the left (toward the origin) at a constant velocity.
25. The car moves toward the left, speeding up at a steady rate.
26. The car moves toward the right at a constant velocity.

Questions 27-29 refer to a coin which is tossed straight up into the air. After it is released it moves upward, reaches its highest point and falls back down again. Use one of the following choices (A through G) to indicate the acceleration of the coin during each of the stages of the coin's motion described below. Take up to be the positive direction. Answer choice J if you think that none is correct.

A. The acceleration is in the negative direction and constant.
B. The acceleration is in the negative direction and increasing
C. The acceleration is in the negative direction and decreasing
D. The acceleration is zero.
E. The acceleration is in the positive direction and constant.
F. The acceleration is in the positive direction and increasing
G. The acceleration is in the positive direction and decreasing

27. The coin is moving upward after it is released.
28. The coin is at its highest point.
29. The coin is moving downward.

Questions 30-34 refer to collisions between a car and a truck. For each description of a collision (30-34) below, choose the one answer from the possibilities A though J that best describes the forces between the car and the truck.

A. The truck exerts a greater amount of force on the car than the car exerts on the truck.
B. The car exerts a greater amount of force on the truck than the truck exerts on the car.
C. Neither exerts a force on the other; the car gets smashed simply because it is in the way of the truck.
D. The truck exerts a force on the car but the car doesn't exert a force on the truck.
E. The truck exerts the same amount of force on the car as the car exerts on the truck.
F. Not enough information is given to pick one of the answers above.
J. None of the answers above describes the situation correctly.

In questions 30 through 32 the truck is much heavier than the car.

30. They are both moving at the same speed when they collide. Which choice describes the forces?
31. The car is moving much faster than the heavier truck when they collide. Which choice describes the forces?
32. The heavier truck is standing still when the car hits it. Which choice describes the forces?

In questions 33 and 34 the truck is a small pickup and is the same weight as the car.

33. Both the truck and the car are moving at the same speed when they collide. Which choice describes the forces?
34. The truck is standing still when the car hits it. Which choice describes the forces?

Questions 35-38 refer to a large truck which breaks down out on the road and receives a push back to town by a small compact car.

Pick one of the choices A through J below which correctly describes the forces between the car and the truck for each of the descriptions (35-38).

A. The force of the car pushing against the truck is equal to that of the truck pushing back against the car.
B. The force of the car pushing against the truck is less than that of the truck pushing back against the car.
C. The force of the car pushing against the truck is greater than that of the truck pushing back against the car.
D. The car's engine is running so it applies a force as it pushes against the truck, but the truck's engine isn't running so it can't push back with a force against the car.
E. Neither the car nor the truck exert any force on each other. The truck is pushed forward simply because it is in the way of the car.
J. None of these descriptions is correct.

35. The car is pushing on the truck, but not hard enough to make the truck move.
36. The car, still pushing the truck, is speeding up to get to cruising speed.
37. The car, still pushing the truck, is at cruising speed and continues to travel at the same speed.
38. The car, still pushing the truck, is at cruising speed when the truck puts on its brakes and causes the car to slow down.
39. Two students sit in identical office chairs facing each other. Bob has a mass of 95 kg, while Jim has a mass of 77 kg. Bob places his bare feet on Jim's knees, as shown to the right. Bob then suddenly pushes outward with his feet, causing both chairs to move. In this situation, while Bob's feet are in contact with Jim's knees.

A. Neither student exerts a force on the other.
B. Bob exerts a force on Jim, but Jim doesn't exert any force on Bob.
C. Each student exerts a force on the other, but Jim exerts the larger force.
D. Each student exerts a force on the other, but Bob exerts the larger force.
E. Each student exerts the same amount of force on the other.
J. None of these answers is correct.

Questions 40-43 refer to a toy car which can move to the right or left along a horizontal line (the positive portion of the distance axis). The positive direction is to the right.

Choose the correct velocity-time graph (A - G) for each of the following questions. You may use a graph more than once or not at all. If you think that none is correct, answer choice J.

None of these graphs is correct.

40. Which velocity graph shows the car moving toward the right (away from the origin) at a steady (constant) velocity?
41. Which velocity graph shows the car reversing direction?
42. Which velocity graph shows the car moving toward the left (toward the origin) at a steady (constant) velocity?
43. Which velocity graph shows the car increasing its speed at a steady (constant) rate?
APPENDIX C:

STUDENT SURVEY
Physics study habits 2

This survey is intended to gather data on how you revise for physics and your attitude toward the subject. Hopefully this will help me create a class where you can learn more effectively, so please be completely honest. Your responses will be kept anonymous. Your gender and birthdate will be used for data analysis purposes only. Participation is voluntary. Participation or nonparticipation will not affect your grade or class standing in any way.

1. What is your gender?
   - Female
   - Male

2. What is your date of birth?
   - dd/mm/yy

3. For each of the following, choose the statement that best describes your feelings about Physics.

<table>
<thead>
<tr>
<th>Statement</th>
<th>1 = strongly disagree</th>
<th>2 = disagree</th>
<th>3 = neither agree nor disagree</th>
<th>4 = agree</th>
<th>5 = strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I study differently for physics than I do for other subjects.</td>
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<td>Physics is difficult for me.</td>
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<td>I don't know how to improve my performance in Physics.</td>
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<td>The teacher prepares the class adequately for tests.</td>
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<tr>
<td>The study strategies I use prepare me adequately for tests.</td>
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<tr>
<td>I frequently use concept maps or some other concept connecting strategy in this course.</td>
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<td>I use flashcards to revise for Physics.</td>
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<td>I use technology as a tool to revise for Physics.</td>
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<td>I find physics challenging.</td>
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<td>I enjoy physics class.</td>
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</table>
4. What do you like best about Physics class?

5. If you could change one thing about Physics class, what would it be?

6. Describe the method or methods you use to revise for Physics. Please be as detailed as possible.

7. Describe any changes you have made in the past three months to the way you study Physics.
**8. Rate the effectiveness of these changes (if applicable) compared to study methods previously used.**

- [ ] Not effective at all
- [ ] Less effective than previous methods
- [ ] Equally effective to previous methods
- [ ] More effective than previous methods
- [ ] Much more effective than previous methods
- [ ] Not applicable, I have not tried a new study method
APPENDIX D:

EXAMPLE OF BGfL MULTIPLE INTELLIGENCES RESULTS
Your answers have been saved using the secret code: vf48n18272c.
To see this chart again, type your secret code into the Results page.
APPENDIX E:

LEARNING STYLES INVENTORY
**DISCOVER YOUR PREFERRED LEARNING STYLE**

This questionnaire will help you discover what kind of learner you are. Read each of the statements and circle the one each row that best describes you.

<table>
<thead>
<tr>
<th></th>
<th>I prefer lessons where we can discuss things.</th>
<th>I prefer lessons where there is something to look at (like a picture, chart, diagram or video) or something to draw.</th>
<th>I prefer lessons where we can do something practical - or at least move around.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>V</td>
<td>K</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>I often fiddle with things in class (a pen, paper clip or rubber band.)</th>
<th>I often sing or hum to myself in class.</th>
<th>I often doodle in class.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>K</td>
<td>A</td>
<td>V</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>When learning a new skill, I prefer to just get on with it.</th>
<th>When learning a new skill, I prefer someone to explain to me how to do it.</th>
<th>When learning a new skill, I prefer to watch someone else show me how to do it.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>K</td>
<td>A</td>
<td>V</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>When the adverts come on the telly – I like to watch them.</th>
<th>When the adverts come on the telly – I get up and do something.</th>
<th>When the adverts come on the telly – I like to sing along with them.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>V</td>
<td>K</td>
<td>A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>I would prefer to listen to a story.</th>
<th>I would prefer to see a comic strip of a story.</th>
<th>I would prefer to act out a story.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>V</td>
<td>K</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>I am good at learning physical skills.</th>
<th>I have a good memory for people’s names.</th>
<th>I have a good memory for faces.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>K</td>
<td>A</td>
<td>V</td>
</tr>
<tr>
<td><strong>I prefer teachers</strong> who use diagrams to show us things.</td>
<td><strong>I prefer teachers</strong> who get us to do something.</td>
<td><strong>I prefer teachers</strong> who explain things to us.</td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------------------</td>
<td>-------------------------------------------------</td>
<td>--------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>K</td>
<td>A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>If I get in trouble in class, it's for talking.</strong></th>
<th><strong>If I get in trouble in class, it's for drawing on the desk or all over my books.</strong></th>
<th><strong>If I get in trouble in class it's for fidgeting.</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>V</td>
<td>K</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>On a long journey I like to look at the scenery or read a book.</strong></th>
<th><strong>On a long journey I can't wait until we stop so I can walk around.</strong></th>
<th><strong>On a long journey I like to listen to music or talk to the other travellers.</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>K</td>
<td>A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>I use my hands a lot when I am talking.</strong></th>
<th><strong>When I am discussing something, I sometimes use words my friends don't know.</strong></th>
<th><strong>When I am discussing something, I like to doodle.</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>A</td>
<td>V</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>If I could be famous, I would be a sports-person (or dancer).</strong></th>
<th><strong>If I could be famous, I would be a film-star.</strong></th>
<th><strong>If I could be famous, I would be a singer.</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>V</td>
<td>A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>I would rather go outside and play.</strong></th>
<th><strong>I would rather watch my favourite TV programme.</strong></th>
<th><strong>I would rather listen to my favourite music.</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>V</td>
<td>A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>I get distracted in class if I can see something outside the window.</strong></th>
<th><strong>I get distracted in class if I can hear something happening outside.</strong></th>
<th><strong>I lose concentration if I have to sit still for a long time.</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>A</td>
<td>K</td>
</tr>
</tbody>
</table>
Add up your total scores: Count how many times you circled each letter.

V =  A =  K =

If V was your highest score you are probably a visual learner. If A was your highest score you are probably an auditory learner. If K was your highest score you are probably a kinaesthetic learner. If you have two or three scores that are very close you might be a mix of two learning styles.

Your learning style can help to inform of the best way to revise. Read the following information for ideas of how to revise based on your learning style. Remember this is a guide only anybody can use any of these techniques and still be an effective learner.
Visual Learners
- Turn notes into bullet points. Highlight key words. Keep shortening them until you have one word which will trigger your memory for each point.
- Make flash cards with the key ideas. (see www.flashcardexchange.com for ideas).
- Practise past exam papers
- Draw Mind Maps for topics to show how the main ideas link together
- Write out key words and definitions on flash cards. Colour code them. Get someone to test you.
- Turn your notes into pictures or diagrams such as flow charts
- Use websites e.g. BBC bitesize.
- Learning posters – put key information on small posters. Use patterns, colour and drawings. Pin them up where you’ll see them often (like in the toilet).

Auditory Learners
- Use Mnemonics to remember key facts (Richard Gave Battle In Vain)
- Make up questions and get somebody to test you verbally. Put aside the ones you don’t know and keep working on them until you learn them all.
- Record notes and put them on an MP3 player. Listen to them as often as possible.
- Make a podcast
- *Make a rhyme, rap or song out of your revision notes (yes it really works!)*
- Read your notes out loud to your cat or dog! Sounds stupid but it works!
- Explain key ideas to a friend. Teaching other people helps you to learn yourself.
- Practise past exam papers

Kinaesthetic learners
- Associate information with actions. Act out your notes as you read them.
- Walk around the room whilst revising.
- Write information on post-its and stick it around the room. Move round the room reading the notes.
- Make up a play involving key ideas and act it out.
- Role play key events or arguments from subjects with friends.
- Instead of reading notes summarise them up using a computer.
- Turn your notes into a PowerPoint and share it with friends.
- Practise past exam papers
APPENDIX F:

LIST OF STUDY STRATEGIES
The following revision methods were introduced and discussed:

- summary notes (123 --> 321, iBook Author)
  - With 123 --> 321, students write summary notes with increasing detail over three cycles, then summarize them over three cycles until they have reduced the notes to the bare minimum required.
  - Tech alternative: Students with access to iBook Author may wish to use it to create their own revision books.

- review notes (JotNot Pro & Evernote)
  - Tech alternative: Notes written on the whiteboard in class are photographed by the teacher with JotNot Pro and the resulting pdf file is posted to the classes shared Evernote file.

- flashcards (StudyBlue)
  - Tech alternative: Students may wish to use flashcard apps such as StudyBlue, which can be shared between classmates or across the world

- concept mapping (CMap, MindNode, Prezi)

- rhythm and rhyme
  - use rhythm or rhymes to remember facts.

- discuss and explain to one another
  - each group member revises a different objective, then take turns explaining the objectives to each other.
APPENDIX G:

QUESTIONS FOR STUDENT INTERVIEWS
Student interviews

As you know, over the past several months we have been exploring how our minds work in order for each of us to better understand our own best method of revision. I would like to ask you a few questions to get a sense of the affect this has had on you. In order to capture all comments I will be recording this interview.

1) Based on the MI inventory you completed, what do you see as your intellectual strengths?

2) How do you best learn? Is there a single way?

3) What effect has learning about how your mind works had on how you study? Have you made any significant changes to how you study?

4) How effective have these changes been?

5) Looking forward, do you plan to make further changes to your revision or study strategies? If so, what has prompted this change?

6) Thanks for your time. Do you have any questions or comments?

7) Have you been able to apply what you learned about how you learn to other subjects as well as Physics and, if so, did the same methods work for all subjects?

8) Would you recommend this process be used for future classes? That is, is it a worthwhile exercise?
APPENDIX H:

POWERPOINT PRESENTATION OF REVISION TECHNIQUES
REVISION TECHNIQUES

L.O-
• To understand how to revise in a way that is best for you.
• To practise revising ‘Better Not Harder’.
• To learn brain friendly revision techniques.

Please remember different techniques work better for different people!

When revising you could do the following:

1. Read through your books
2. If you do not understand something ask somebody.
3. Choose the memory tricks that work best for you
4. Create posters to help you to organise information
5. Create cards with key points and practice
6. Use past papers to practice answering questions

OR

FREAK OUT!
Your own notes are best.
Whilst revision guides can be useful, the more you personalise your revision the more effective it will be, so the notes you make are best. The process of making the notes is part of your revision and once you “own” the work it is easier to remember.

Chunking
Chunking is breaking up a big piece of information into smaller chunks rather like steps in a ladder. It can be used for numbers and words. Often students use Bullet points to break up information.

Try to remember this by breaking it up into chunks:

The average person can take in four numbers or words at a time, can concentrate on revision for a maximum of 45 minutes at a time and remembers information best shortly before bedtime.

Chunked:
- Remember 4 words/numbers at a time
- Revision max 45 mins.
- Remember best before bedtime
Mnemonics help you to remember by using short words that stand for something to help you. Here is a Mnemonic for REVISION.

Rest
Exercise
Variety
Imagination
Structure
Individual
Ongoing
Not too long

Association helps a lot of people to remember, because it is much more powerful when we use our imagination. The idea is to link objects and ideas to each other in the craziest way possible.

Mind maps (Also called Spider grams) are good for remembering topics and sub-topics, such as characters in a book. On the other hand, concept maps are good for remembering items where the order is important, such as the storyline (plot).
1. Imagine a Mind map is like a giant Spider's Web with all the ideas around it. The spider (or main idea) is in the middle and everything is around it. The most important ideas are in the middle and the sub-topics go out further and further.

2. Now imagine that Spider's Web falling down and turning it into some kind of weird chain with the words concept map on it. The spider can go backwards and forwards and around so he knows how ideas connect, but there are no sub-topics.
Two ways to practice with cards:

1. Put the answers on the back, but you will need to remember more at once before you check.

   OR

2. Use a piece of paper and move down to reveal answers as you guess the contents.

These techniques are very useful for checking that you know key facts.
Loci is the memory trick of memory masters. It involves thinking about a journey that you know well and the landmarks along the way. You then add in images to help you remember information. (They do not have to be famous, but things that you notice as you go by.)

Now let us take a journey from New Bridge to Macy’s Academy.

1. On the bridge itself you see a huge book.
2. You reach the large roundabout and see your teachers, your last English lesson and the person that sits next to you in class.
3. You see the houses on the left and there is a magician performing magic tricks.
4. On a billboard on the fence of Macy’s you see a huge poster with your revision on it.
5. As you walk into the gate you see a huge pile of revision cards.
6. When you arrive into the canteen you see test papers set out for you on all the tables.
By Rote

Learning by rote is simply reading the text over and over until you remember it. It is the most basic kind of revision, but without the help of other techniques may not be very effective and it can be very boring. There are a few students with excellent auditory memories, who can learn effectively this way.

By Rote

Read it again and again and again and again and again and again and again and again and again and again and again and again and again and again and again and again and again and again and again and again and again and again and again and again and again and again and again and again and again and again and again and again and again and again and again and again and again and again and again and again
Now let's see how many you have remembered?
Which words did you remember?
- let's hear as many of them as you can remember.

- You remember the words at the beginning and at the end, it's the ones in the middle that get lost
  - why?
- It helps to make categories of words in your mind - colours, modes of transport, moods etc.
- It helps to make links or associations - fish, chips, peas, salt and vinegar
- It helps if words are repeated - e.g. 'the'
- Some words stand out
- Some words have strong emotion attached to them, e.g. 'exams'
OK, now we are going to try this again and this time try to focus on listening for **categories** and see how many you can remember this time.

I can tell you there are four categories of words in this list.

Believe in yourself.

**I can do this**

Remember:

Whether you think you can or you think you can’t, you’re probably right.
**Order/Sequence**

Have a look through your notes/books and order or sequence the notes. Place them in a logical sequence so you can see how things progress. You may find a more logical way of seeing things.

**Reading Out Loud**

Read your revision notes out loud to a particular rhythm - this could be set by music playing in the background or tapping your foot or by walking calmly and steadily. This is a sort of walk and talk.

---

**Brain Friendly Revision**

**Change key words in the topic for pictures or symbols or abbreviations and use those in your revision**

**Q & A**

Devising questions and answers about a topic for other people and quiz each other.

You could think of doing a “Who wants to be a millionaire” game where the questions are graded according to the difficulty you choose.
Brain Friendly Revision

Questions

Ask questions before you revise anything. Think about the topic to be studied and take some time out to think about the questions you would like to have some-one answer for you. Write them down and as you read through your notes jot down any answers you find.

The brain likes looking for answers. Go and get help for any answers you do not find.

Post-its

Write information on post-it notes and place them on the wall, door, large sheets of paper etc. You can then rearrange them according to a variety of ideas:

- Group various things together
- Organise them into what you know and don't know - rearrange as you learn more
- Follow trends or themes

Brain Friendly Revision

Tapes

Make a tape for yourself to revise from. It could be you reading your notes out loud. It could be you singing your notes.

- It could be you reading and then stopping to summarise what you have read (key words, ideas, phrases, quotations)

or

Ask questions on what you have covered.

Listen to the tape as you lie in bed, walk to school, travel on the bus.

Visuals

- Make good use of drawings/diagrams in your revision.
- Use different colours.
- Replace key words/ideas/people/places with pictures.
- Create and put posters up around your home.
Brain Friendly Revision

**Highlighters**

As you read through your notes use different coloured highlighters to pick out key words, themes, ideas, points etc. You could try a different colour for each theme or topic. There are revision websites where you can read revision notes and highlight as you go. You can use very small post-its to highlight things as you go along.

**Underlining**

- As you read through the work in your exercise book underline key words.
- You could come up with a predicted list before you start or you could make a list of the key words at the end.
- You could underline in different colours, patterns or lines like wiggly, thick etc.

Brain Friendly Revision

**Make lists**

- Bullet point them
  - Or
- Number them
  - Or
- Letter them
  - According to what suits you best. Numbers will definitely suit those who are more comfortable using their left/logical side of the brain.

**Use Colour**

Your brain just adores colour and will remember things much more easily if you use it.

E.g. put all the important words in red, the important concepts in green, important dates in purple etc.
Brain Friendly Revision

Re-write the topic in your own words. Find out why you are learning it—then make it interesting for you.

Reward yourself Once you have learned something give yourself a treat. Go out with some friends for an hour, watch TV but only once you have reached your revision target.

Helpful tips. On the day:

Make sure you have everything you need.
- A watch
- Pens, pencils (spare or sharpener), ruler
- Calculator if needed and allowed (spare battery)
- A pen you can write with quickly, comfortably and legibly

Make the most of your short term memory. Learn the 10 most important facts whilst waiting to go into the exam and write them down as soon as you are allowed to pick up a pen.
**In the exam**

- Read:
  - the instructions.
  - all of the questions before you choose which to do.
  - each question carefully.

- Time yourself

Divide the time appropriately between the number of questions you have to do and watch the clock to stick to this.

Do not panic if you run out of time - but make sure you round off your answer even if facts are missing - conclusions are worth a lot.