Visualisation Skills for Engineers

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Context

Reading College is a vibrant general further education (FE) college situated in Reading, Berkshire and is part of Activate Learning which aims to transform lives through learning. The college has a broad range of curriculum areas that commonly aim to enable students to go further than simply gaining a qualification. The engineering department offers full time programmes at level 2 and 3 in general engineering and Higher Education (HE) and apprenticeships in electrical/electronic and mechanical engineering disciplines. There is in excess of 200 students enrolled within engineering at Reading College. Most full time and part time (apprentices) undertake BTEC as their study programme where students learn a range of practical skills and theoretical principles in relation to criterion referenced learning outcomes against the assessment criteria.

I am an Engineering Lecturer at Reading College; the subjects that I teach are Mechanical Principles and Applications (MPA), Engineering Design, Computer Aided Design (CAD), Health and safety, and Maintenance.

The group that I have selected for the intervention is a group of 21 students that I take for Mechanical Principles and Applications (MPA). The group dynamic is challenging as there are a number of very strong characters who can be boisterous during lessons alongside some who are very quiet and reluctant to engage.

My target will be to see if I can help the ones that are struggling to engage better and visualise a way to engage and find solutions to their assignments.

The 'problem' or issue you have addressed

Many students have an issue in not being able to think of solutions to problems independently and in particular not being able to visualise the problem to find a solution. They are always so keen to give up and unwilling to undertake activities that require them to push themselves harder or to think.

The trigger was watching the students trying to do tasks and assignment work that had been taught, and they were still struggling how to visualise the solution. This posed a question: was this down to my method of teaching or was it the students' lack of effort, visualisation or even determination?

Review of current practice and literature

I'm a qualified facilitator for the STEPS and PX2 program from The Pacific Institute, the course is designed to help people with confidence and goal settings by helping identify blind spots (scotomas), and the benefit of effective thinking skills. By having a clearer idea of what you want to achieve or goals in life.

There is a lot of Cognitive Behaviour Therapy (CBT) data and theory already out there for easy access for anyone, the course that I facilitate for The Pacific Institute is a basic CBT view on the visualisation process and our thought process to achieve goals that we set ourselves.

Some of the useful links are detailed below that I have used to research visualisation skills:

Mind is a very informative site giving plenty of research data
http://www.mind.org.uk/information-support/drugs-and-treatments/cognitive-behavioural-therapy-cbt/#.VZrdTvlVhBc

The Royal College of Psychiatrists has an excellent reading suggestion The Young Mind which is co-edited by Sue Bailey and Mike Shooter.
http://rcpsych.ac.uk/usefulresources/publications/books/rcpp/9780593061381.aspx

The Teaching English on the BBC website gives a very good explanation on what visualisation is and some guidelines on its use in the
classroom. http://www.teachingenglish.org.uk/article/introduction-using-visualisation

Maggie Dent has tips on using visualisation and mental rehearsal in the classroom
http://www.maggiedent.com/content/using-visualisation-and-mental-rehearsal-classroom

My Research Question

"If I enable my learners to think laterally will they improve their visualisation skills as a result?"

The Project

The first two weeks I started the lesson with game using flash cards showing isometric and plans drawing views. Each isometric card has three corresponding plan views, but most of the cards have very similar views so it is easy to choose the wrong cards for your set. The idea of the cards is to help with the understanding of isometric and plan views, a very successful resource for learning Computer Aided Design (CAD).

The first week I gave them an isometric card, then they were challenged to find the corresponding plan views. The simple visualisation game was slow to get started but after a

few minutes they were all trying to get complete sets. As expected the first few attempts to get the set complete resulted in them choosing the wrong cards, but they all manage to complete at least one set. After this the group were a lot more focused on the rest of the lesson, which was a surprise to see this response after only one session with the cards.

The following week I used the same cards but this time the challenge was to get a complete set from one plan view. This involved the class to work together to swap cards to complete their sets. This time they were all more focused on the challenge from the start compared to the previous week. Again the lesson progressed on without any problems and another good session was had by the students.

The following two weeks I started the lesson with visualisation image test sheets that were an extension on the previous week's work. These were simple multiple choice sheets with only a few images on. The goal was to see if they could visualise the correct image and start to think outside the box.

The last two weeks I started with statements on cards to highlight the fact that we do not read everything as it is written, i.e. blind spots caused by the way we are taught to read. Why do we have blind spots or scotomas anyway? These cards I have used in the past on the STEPs courses that I had facilitated.

The first card has the following statement:

> "FINISHED FILES ARE THE RESULT OF YEARS OF SCIENTIFIC
> STUDY COMBINED WITH THE EXPERIENCE OF MANY YEARS"

The idea behind this card is first to allow a quick read of the card, only once then put it face down. I will then ask them to count the number of F's in the statement. You always get between 3 and 6 F's, you then swap the cards around. As expected they get the same result on a card that had a different count by someone else (the cards are the same). This then opens a discussion on why? it is down to how we read the word OF as OV and we fail to see the F. So if we are missing an F or two in just reading a statement, what else are we missing that is stopping us from succeeding?

Are our own visualisation skills limited by our own past experiences, not by our own ability?

The following week I used another two cards where the writing has been printed differently, the text was white and the space between the letters was black. When I handed out the cards I first started to focus on the shapes the black spaces made, then expanded from there. As always, most people were unable to see the actual word written down, and again this is due to the way we are taught to read at school.

The recording process was going to be through observations on classroom behaviour and quality of work produced over the intervention period.

Findings

Before the interventions started I predicted the success rates of students I teach within the whole group, including the experimental group of 4 students. There was a clear indication at this time that a few of the students were in danger of not completing the unit assignments. From this I decided to focus on those students that were experiencing difficulties in the hope of enabling them to focus and complete the work set.

The first two weeks showed the greatest improvement in the classroom habits and behaviour as they were more focused and less distracting to the others in the class. The following weeks there were signs of smaller improvement and better quality of work was starting to be turned in.

I have to also bear in mind that the end of the academic year is close and this could have had an impact on the outcomes and behaviour of the class. All I can say is that the students have actually started to produce good assignment work, which is great.

The interventions do show the benefit of visualisation skills in the lesson, due to the improved work done by the target students who were at risk of failing and are now on the verge of completing mechanical principles and applications.

Lessons Learned and next steps

The intervention tasks seemed to work, as the students did start to produce work and be better focused in the class. One of the students that I was concerned about not completing has actually completed his assignments for me. The remaining members of the class have been more productive as well.

The intervention needs to be done from the start of the academic year to be able to get true results on the effectiveness of visualisation skills in the engineering world.

On reflection I could have used more data recording, which is what I want to do as I take this further from the start of the new academic year.

Engineering is often seen as a 'doing' skill or at least a 'psychomotor' skill or process thinking - I am wondering is there something about the affective domain that will be worth teaching 'self-actualisation'?

My next step is to expand on my skills from my own knowledge as a STEP's facilitator and look into a CBT qualification. This will give me the ability to explore this further, and identify is there a relationship in using CBT skills in the curriculum to strengthen the visualisation skills required for the engineering habits of mind.

References

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