Quizzes – Just a Matter of Fact?

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ABSTRACT

Quizzes are usually regarded as just a way to help people remember bare facts. An Action Research project studying a group of final year undergraduates indicates that quizzes accompanied by brief discussions can be more valuable.

Students on a one semester Technical Editing course were given a short quiz every three weeks. Most of the students felt that these activities helped them to understand concepts, or even to apply them.

At the end the students filled in a standard module evaluation form. A third of them, unprompted, picked out the quizzes as a positive learning experience.

The quizzes were also used as a simple way to get quick feedback on the effectiveness of teaching and learning, and provided pointers for preparing revision exercises.

It appears that the quizzes and discussions, plus the targeted revision exercises, worked well because they provided spaced reviews, gave practical examples, and were very participatory.

1. INTRODUCTION

This investigation looked into the effectiveness of quizzes, with accompanying discussions, as a mechanism for improving recall on a final year undergraduate Technical Editing module. My previous experience of a similar technique had suggested that it could have a positive effect on retention and understanding.

The original theory of the memory retention curve goes back to Ebbinghaus in 1885 (1), who showed we forget about 75% of what we learn after 48 hours. He advocated "staggered learning" with spaced reviews. On this basis teachers commonly repeat material, or re-present it in a different form, to help their students to remember it.

Petty (2) suggests that "Students need activities which encourage them to process new material. Activities that make students use – and hence develop a personal restructuring of – the ideas you are trying to teach them will make them learn more efficiently than passive actions such as listening"

In other words, active, participatory learning is more effective than passive learning, or in the words of the old saying: "I hear and I forget; I see and I remember; I do and I understand"

Honey and Mumford, in Reece and Walker (3) suggested that the effectiveness of different learning methods depends on students' learning styles:
"Activists enjoy the present, like the immediate experience and respond to short term issues. Reflectors prefer to think about things and explore all aspects before coming to a conclusion. Theorists like principles, theories, models and systems. Pragmatists look for new ideas and are keen to experiment"

Petty (4) says:
"The most effective learners use all four styles at appropriate times……. A teacher can only suit all learning styles by using a good mix of teaching methods"

Buzan (5) goes further than other authors, claiming that maintaining knowledge by spaced reviews can eventually lead to creative thinking. However he presents little evidence for this assertion, which could be seen as part of a "sales pitch" for his memory map system and his popular books.

The original work such as Ebbinghaus, and much research since, has been based on very simple rote-learning tasks such as pair associations and learning foreign language vocabulary. Kintsch (6) explored problem-solving, for both well-structured and ill-structured problems:
"A problem is well-defined when we have a schema for it, or when we understand its problem space" but he concludes: *"Clearly, the question of how knowledge is used in problem solving is far from answered".*

2. ACTION PLAN AND RESEARCH DESIGN

2.1 The group being studied

The subjects for this study were a group of sixty final-year undergraduates studying a Technical Editing module at the University of the West of England (UWE). They were taking this module as a component of various degrees, so some were more accustomed to technical subjects than others. Most of the group were in their early twenties but there was a scattering of mature students. There were slightly more men than women.

Each week all 60 students attended a large lecture, followed by a tutorial in a group of fifteen.

2.2 Topic of research

Based on the theories above, I decided to try to develop a teaching method based on:

- Spaced reviews - for improved recall
- Activities – to help students process the new material
- Mixed questioning and discussion - to encompass various learning styles
- Discussion – to build up a schema or mental framework, to deepen understanding

I decided to use a "team quiz" approach for the following reasons:

- To increase recall in line with Ebbinghaus's theory
- To motivate students by introducing an element of non-threatening competition
- To identify misconceptions and deepen understanding by brief discussions accompanying each quiz question

2.3 Choice of research method

As the group concerned were final-year undergraduates, they have considerable awareness of the progress of their own learning – they could be regarded as "expert learners". I therefore decided to measure the effectiveness of the method by asking them to assess it through questionnaires. An extra motivating factor was that the questionnaires allowed students to "vote" for the subjects to be covered during group revision sessions later in the course.

2.4 Objectives of research

The points which I wanted to address were as follows:

- Does a team quiz plus discussion help students to remember/understand the topics?
- Does this activity just help students to remember facts, or does it help to develop a deeper understanding?

2.5 The Action Research approach

I adopted a recursive or Action Research approach. Atweh et al (7) explain Action Research as: *"a spiral of self-reflective cycles of:*

- *planning a change*
- *acting and observing the process and consequences of the change*
- *reflecting on these processes and consequences, and then*
- *re-planning, and so forth"*

I decided to conduct three quizzes, each accompanied by a questionnaire. After each quiz and questionnaire I analysed the results and used them to design the next quiz and other teaching activities, and also to decide what information I wanted from the next questionnaire. Hopefully after three iterations I would have a useful teaching tool.

The plan was to run on a three week cycle during the eleven weeks of the course. There would be three questionnaires. Each questionnaire would contain research questions and also gather votes for revision topics.

3. QUESTIONNAIRE DESIGN, DATA COLLECTION AND ANALYSIS

3.1 First iteration – Quiz 1 and Questionnaire A

In the first questionnaire I asked students to tick one of these for each topic –

- I already knew or understood this topic before the quiz
- The quiz, and talking about the answers, helped me remember or understand
- I still don't know / understand it. The quiz and talking about it didn't help.

I found that the "average" student (out of 45 responses) knew 31% of the answers before the quiz, and found that they were helped by a further 55% of the questions, answers and discussions (Figure 1).

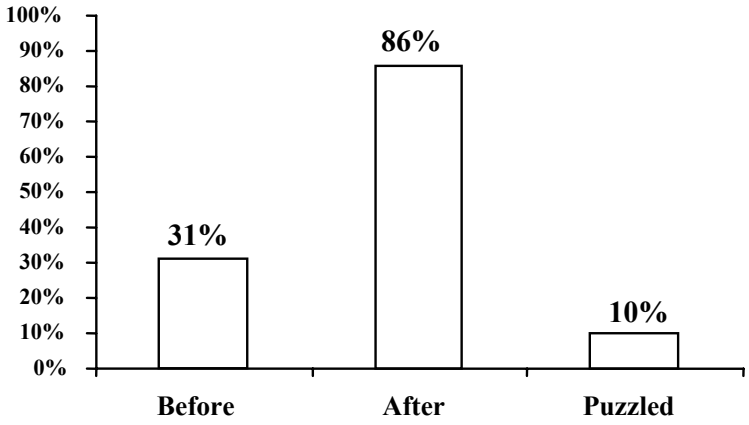

Figure 1 – Topic recall before and after Quiz 1

Then I realised that I had asked two broad types of question:

- Questions involving on remembering facts through rote learning, which I termed as being at a low cognitive level; and
- Questions involving understanding concepts, i.e. at a medium cognitive level.

When I split the results (admittedly using my own subjective judgement about the questions) I obtained the results in Figure 2. This implied that the initial level of recall for understanding concepts was higher than recall of rote learning, but after the quiz the recall levels were almost the same.

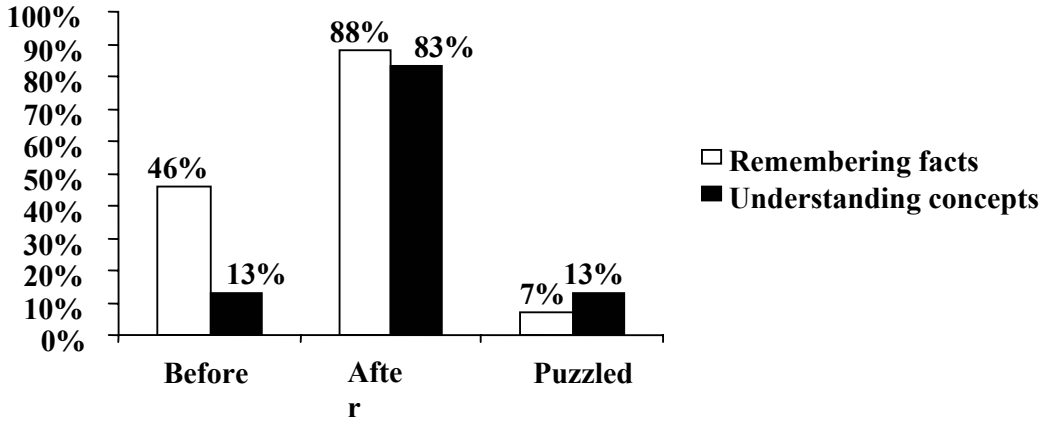

Figure 2 – Topic recall before and after Quiz 1, split by cognitive level

3.2 Second iteration – Quiz 2 and Questionnaire B

I thought that the evidence from Questionnaire A – that quizzes were more effective on medium cognitive topics than on low cognitive topics - was counter-intuitive, and decided to triangulate my results by means of Questionnaire B.

The Questionnaire B results for topic recall, split by cognitive level (Figure 3) were less conclusive. The low cognitive questions showed similar gains to the first quiz, but the medium cognitive topics showed less dramatic gains than in Quiz A – but the students still perceived a 51% gain in recall of medium cognitive topics.

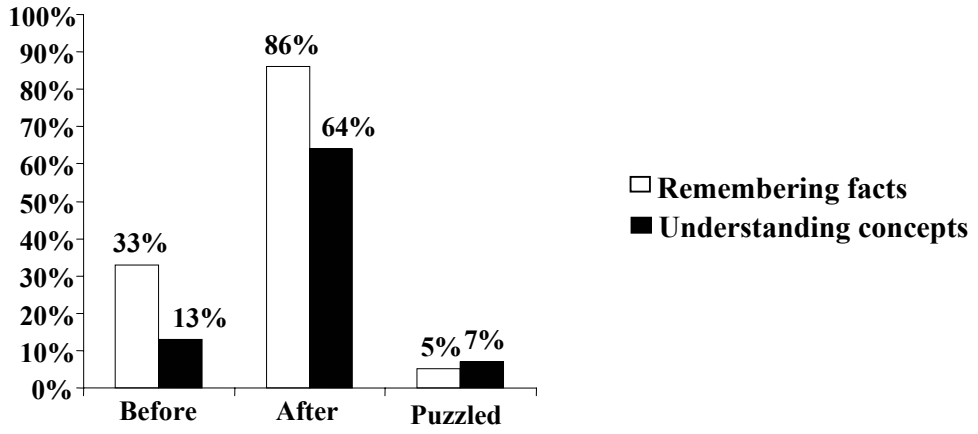

Figure 3 – Topic recall before and after Quiz 2, split by cognitive level

I also asked the students "Does this type of quiz and discussion help you personally to:

- Remember facts?
- Understand concepts?
- Apply concepts?"

I had not in fact set any quiz questions which required the application of concepts – a high cognitive level. All the topics were low or medium cognitive level. Even so, most students felt that the quiz helped them to apply concepts as well (Figure 4).

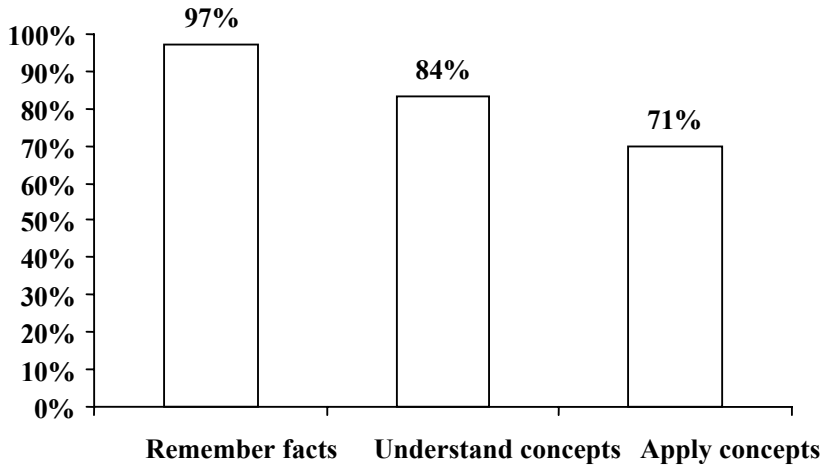

Figure 4 – Perceived benefits from Quiz 2

At this point in the research I presented my interim results to fellow students on my PGCE course, and compared their initial views with my UWE undergraduates (Figure 5).

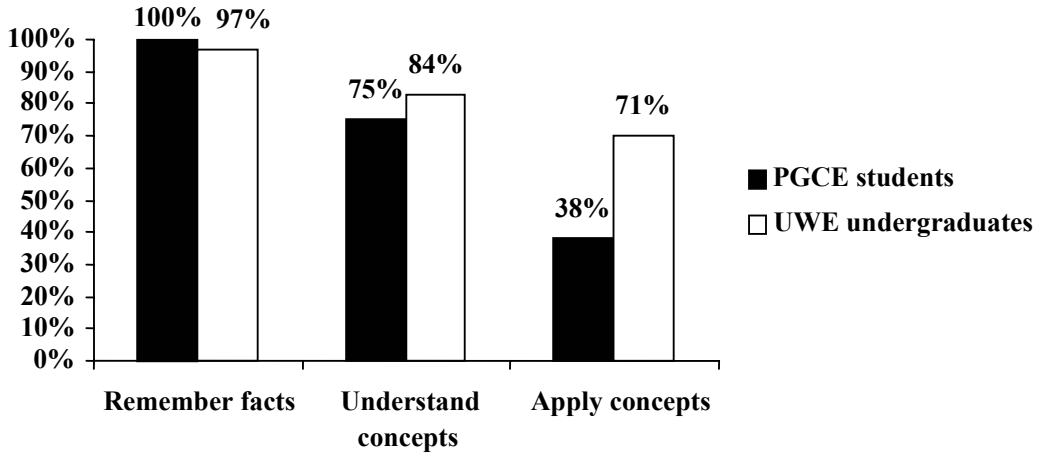

Figure 5 – Perceived benefits – PGCE group compared to UWE undergraduates

A note of caution – the PGCE group was only 8 students, so there could be more statistical variation.

With that caveat, these results provide some more useful triangulation:

- There is almost no difference in the perception that quizzes with discussions help people recall facts.
- There is a small difference in the perception about understanding concepts.
- There is a large difference between the perceptions regarding applying concepts - the UWE groups, having experienced the quizzes with discussions, have significantly more confidence.

Suspecting that this could be the case, I had also included qualitative questions asking the UWE students to explain their thinking. Typical responses – from both enthusiasts and sceptics - are as follows:

It helps me apply concepts because:

- *Gave practical examples that could actually be used, helping to understand application*
- *Discussion helps to understand and apply concepts*
- *Concepts are made clear, so can be applied*
- *More informal environment and user involvement*
- *Examples of concepts where demonstrated*

It doesn't help me apply concepts because:

- *Only physically doing the task helps, although there is some benefit*
- *Cannot apply the concepts without the practical side*
- *Application is limited by the amount of practice available*
- *The quiz is only outlining certain topics and doesn't go into great detail*

The two sets of responses helped me realise that the mini-discussions provoked by each quiz question usually involved me giving illustrations of how the particular concept could be applied. They also showed that students believed practical work to be very important.

3.3 Third iteration - Quiz 3 and Questionnaire C

The final quiz and questionnaire was based entirely on "medium cognitive level" topics. The results further supported the findings of Questionnaires A and B, that students gain significant recall from the quiz with discussions. Allowing for the changes in level of quiz question, getting more complicated as time went on, the results are broadly comparable (Figure 6), indicating the reliability of the method.

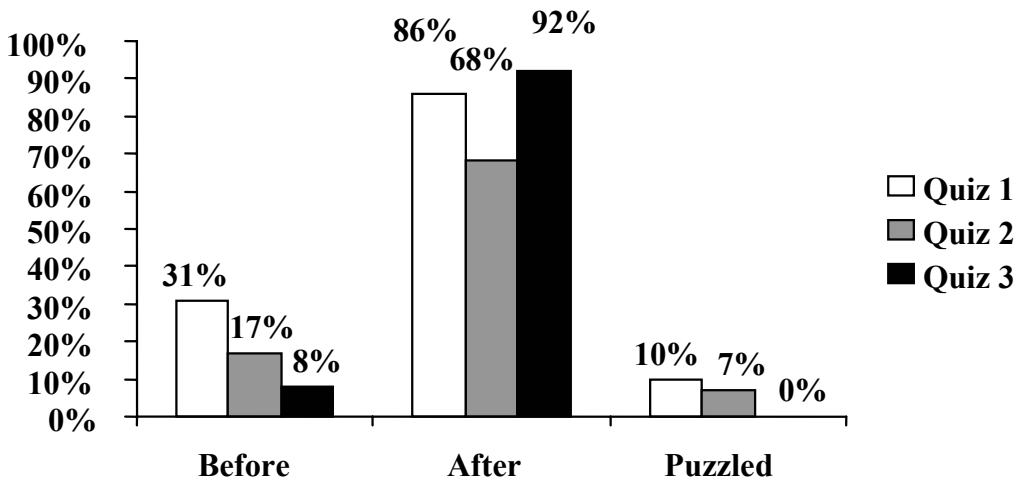

Figure 6 – Topic recall before and after quizzes 1, 2 and 3

The reduction in the "recall before quiz" figures shows that I was increasingly targeting the quizzes on topics where I thought the students needed extra work, and the reduction of the "puzzled" figures may show that I was setting better-constructed questions.

3.4 UWE standard module evaluation questionnaire

On the final week students were asked to fill in a UWE standard module evaluation questionnaire. A third of the responses mentioned the quizzes in the free-format questions:

Quizzes incite me to learn more
Good tutorial quizzes (multiple answers)
Quizzes good revision technique
Quiz every three weeks good, sort of reminder
Quizzes very useful
Quizzes were helpful
Made interesting with challenges
Quizzes good idea

Such a proportion of unprompted, positive comments would seem to indicate that the quizzes were a means of motivation and a good aid to learning.

4. SUMMARY OF RESEARCH CONCLUSIONS

- The subject group consistently felt that the "quiz and discussion" technique helped them to remember or understand the topics covered.
- Almost all these "expert learners" feel that it helps them remember facts.
- 84% of them feel that it helps them understand concepts.
- 71% of them feel that it helps them apply concepts.
- Some apparent reasons why the quizzes and discussions succeeded were that they provided spaced reviews, they gave practical examples and they were very participatory.

I introduced the promised revision exercises at the end, with topics based on the student "votes" in all three questionnaires, students' assessment of recall of different topics and my assessment of student learning based on their quiz answers.

The object of the revision exercises was to give students a quick overview of what they needed to revise – another spaced review - and to give them a self-help tool to diagnose their weak points. The students said that the revision exercises were very useful, and that they were much better than the usual undirected revision question and answer sessions with the tutor.

The students' assignments and their exam results were in general very good.

5. EVALUATION AND FUTURE APPLICATIONS / DEVELOPMENTS

Within the limitations of the time available – my own and the students - and with the proviso that some of the data is subjective, I am convinced that I have established a useful teaching tool, one that I would certainly use again. In fact the quiz and discussion technique seems to have wider applications than I suspected, particularly in teaching students to understand concepts and possibly even to apply them.

The qualitative responses led me to introduce more participatory activities into the later sessions of the course. I am migrating the course to a Virtual Learning Environment next year and I will include more interactive features as yet another layer of spaced reviews.

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