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Active learning to improve long-term knowledge retention

Introduction

An ancient Chinese proverb says: “I hear and I forget, I see and remember, I do and I understand”, clearly indicating that the idea of active learning producing understanding is not a new concept. Balleck (2006) reported that “the use of active learning in the form of simulations, student presentations, and problem-solving situations will better prepare students to understand” (p. 1), following in the same line as the Chinese of milleniums before. Although research has stated the positive effect that the use of active learning through simulation techniques has upon knowledge acquisition (García-Carbonell, 1998; Rising, 1999, 2004), professionals involved in education at all levels are still struggling to make sure that this acquisition, introducing active methodologies in the classroom, turns into understanding and retention so that formal instruction becomes a precursor to life-long learning (Croxton, 2001).

As mentioned in Montero et al. (2008), much has been written about the benefits generated by active participation in collaborative work compared with traditional lecturing. Basically this comparison can be summarized as a more effective development of high-level thinking processes, more effective learning, greater retention of knowledge, a higher degree of student satisfaction; and higher student self-esteem. (Kulik & Kulik, 1979; Smith, 1977; Johnson et al., 1998; Slavin et al., 1985; Rau & Heyl, 1990; McKinney & Graham-Buxton, 1993). These five pillars can be construed to be the learning objectives of collaborative, interactive processes. In this case we will be looking at the third of these objectives: greater retention of knowledge.

As teachers we need to ensure that the largest possible amount of information goes from students' short-term memories to their long-term memories and, therefore, we apply techniques that encourage the retention of information. Kolb & Fry (1975) created an experiential learning circle out of four elements: concrete experience, observation and reflection, the formation of abstract concepts and testing in new situations, graphically represented as shown in Figure 1:

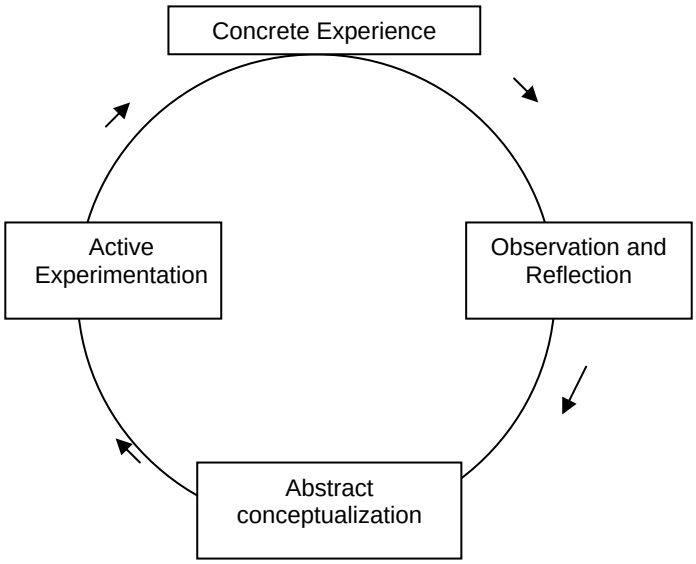

FIGURE 1: Kolb & Fry's experiential learning circle

In their article “The learning way: Meta-cognitive aspects of experiential learning” A. Kolb and D.A. Kolb (2009) modify the model slightly, adding a two-way arrow labelled “grasp experience” between concrete experience and abstract conceptualization and another two-way arrow bewteen active experimentation and reflective observation labelled “transform experience.” These arrows add to the cognition of learning i.e. learning to learn, and consequently, to the retention of what has been learned. This cycle, repeated in a spiral effect, is the basis of learning and the understanding which leads to the retention of what has been learned. Dale (1969) reflects in his “cone of learning” that the activities performed in the process, the senses used and the nature of the involvement have a clear influence on retention. According to this author, by means of verbal and visual reception (i.e, passive

involvement), after two weeks we remember 10% of what we read, 20% of what we hear, 30% of what we see and 50% of what we see and hear. However, after two weeks with active involvement in which reception, participation and performance are implied, we still are able to remember 70% of what we say (e.g. participating in a discussion or giving a talk) and 90% of what we say and do (e.g. doing a dramatic presentation, simulating the real experience or doing the real thing). Therefore, the more actively involved we are, the better we will remember what we have been taught.

The eminent psychologist Ebbinghaus (1885) pioneered the experimental studies on memory retention and studied the difference between recognition (e.g., recognize which of the items had been on the list studied), and recall (e.g., remember each item). The real learning process requires not only recognition but also recall (i.e., coming up with the information from memory). Short-term memory implies temporary retention of information as distinct from long-term retention of information. How quickly and reliably we recall knowledge in the long term depends on the amount of time elapsed after its study and the activities used to put the new concept into practice, purposeful learning experiencies being, in our opinion, the most effective ones.

Aim of the study

Although the positive effect that the use of active learning has on knowledge acquisition is widely accepted, there is still a need to know the effect of active learning on knowledge retention. As early as the late 1970s and early 1980s, conflicting results were reported. In two meta-analyses, one by Pate and Mateja (1979) called "Retention: The real power of simulation and gaming?" involving 16 previous studies and another by Dekkers and Donati (1981) entitled "The integration of research studies on the use of simulation as an instructional strategy" in which 20 studies were included, the conclusions reached were diametrically opposite. While Pate and Mateja stated that "the retention phenomena held up over the diversity of the studies" and found the results "exciting" (p. 200), Dekkers and Donati found that "The evidence from these analyses does not support the contention that simulation activities in the classrom result in an increase in cognitive development or retention when they are compared with other teaching strategies." (p. 425). Both studies called for more research and post-tests delayed over periods longer than a few weeks. In later studies these opposing results continue to be reported. In "A comparison of short term and long term retention: Lecture combined with discussion versus cooperative learning", Morgan, Whorton and Gunsalus (2000) reported "minimal differences . . . in long-term" (p. 53) whereas Balleck (2006) in "Teaching for the future" found that "the use of active learning, in the form of simulations … will better prepare students" (p. 1) and lead to percentages of retention between 75 and 90. Specht and Sandlin (1991) found that "the key difference in the two learning methods [experiential and traditional] is the students' retention of the concepts over time" (p. 196). The objective of our study was to try and shed more light on this controversy and reach constructivist objectives concerning the students' learning process and compare linguistic knowledge retention of students in an active learning environment with students who were taught by means of a traditional approach.

Hypotheses

The research questions in our study try to confirm the following hypotheses:

1. Students' short-term knowledge retention in the experimental group (active learning techniques) will be considerably higher than that of the students in the control group (using lecture/discussion techniques).

2. Long-term knowledge retention of information will be higher in the experimental group than in the control group.

Method

The methodology used takes into account that European Higher Education requires a profound modification of the current educational models, establishing new systems with active student involvement, using small teams, simulations, role-plays and other activities (Meyers & Jones, 1993) in the teaching/learning processes, fostering collaborative learning based on group learning. But, what is the most effective method of teaching? The answer to this question is, according to McKeachie & Svinicki (2006) that it depends on the goal, the student, the content, and the teacher. But according to these authors, the best principle is to have students teach their classmates. In contrast to the students of the control group who are taught by means of a traditional approach, our experiment uses McKeachie and Svinicki's theory and puts into practice a teaching method in a collaborative environment involving the students of the experimental group in the planning and development of their learning process. In our case, the students were assigned a grammatical content and were required to become specialists in it (see, Montero et al., 2008). The students in this group took over the teacher's tasks in class, which implied an immersion in the preparation of appropriate teaching material such as a traditional teacher would do him/herself. Short- and long- term retention of the material presented was later compared with the control group.

In order to measure short-term retention, an achievement test was administered to the experimental group and the control group after finishing the course and a test was administered to all of them after eight months to measure long-term retention. This eight-month delay is in line with the recommendation of previous studies which used only several-week delays and suggested a longer time frame (Pate & Mateja, 1979). The tests consisted of a set of multiple choice questions concerning the grammar and vocabulary components of language, which were basically used to evaluate recognition. To evaluate recall a rephrasing exercise was included in the same section of language components. The test ranged from 1% to 100%, which implied that the students had to obtain at least 60% to pass the test.

The participants in this project were sixteen students of English as a foreign language who were assigned to the experimental group engaged in active learning and sixteen other students who were assigned to the control group receiving traditional teaching. The students had different levels of English: from low intermediate to upper

intermediate level of English. The experimental group was then subdivided into teams. The size of these teams is important to reach maximum performance from each and every one of the students. In small groups or teams there is better cohesion, intimacy, safety and trust. Following the advice of Felder & Brent (2005) who suggest forming teams with a minimum of three people and a maximim of five, this experiment used teams of four. The teams were formed using the results of a diagnostic test[1] so that they would have a heterogeneous linguistic level. In this way it was also possible to observe whether the students in cooperative teams learn from one another (Haller et al., 2000). The gontrol group was not subdivided into teams.

In our experiment, the following instructor factors pointed out by Curry (2001) were taken into account: that there be a challenging project, clearly stated project requirements, flexibility in meeting project requirements, that the project be subdivided with general guidelines for team formation, allocating time for team relationship building and maintaining teacher availability to students. As for the students, the requirements by Curry (2001) were also followed: that team member roles and responsibilities be defined, that team goals and deadlines be established, that guidelines for team communication and the resolving of differences of opinion be established, and that regular meetings be scheduled.

Activities developed by the teams in which the experimental group was subdivided:

1. Each team delved into the theoretic content connected to the grammatical point assigned and designed the graphic presentation. The team also designed practical exercises to illustrate the grammatical topic chosen and applied specific vocabulary to the field of the student. The team was responsible for all of its members reaching competence in the assigned topic.

2. Each team, in the role of "teacher," presented in the classroom before all the students the topic studied and had the other students solve the practical exercises they had designed. The professor or a drawing-of-lots decided which part of the work was presented by each member of the team, as suggested by Felder & Brendt, 2005. In this way the implication of each student in all the work and his/her competence in it was guaranteed.

The objective of these activities was that the whole class learn the grammar presented, be it the use of prepositions, modal verbs, infinitives, etc. and vocabulary for specific purposes, be it computer science terms or library science terms, etc.

Results and discussion

In our experiment, the involvement of the student in the planning and development of the teaching/learning process was reached by integrating theory and practice through the study of the linguistic topic and the generation of teaching/learning material and assessment. Table1 shows the differences obtained in the scores of the teams that formed the experimental group. The results are compared with the ones obtained by the control group.

	Mean Scores	
	Achievement Test. Short-term retention	Post-Test. Long-term retention
Experimental Group	78.1%	70.6%
Control Group	71.9%	54.25%

TABLE 1: Short-term retention vs. long-term retention

Regarding the first research question, i.e., if there are differences between the scores of students in the experimental group and the students in the control group, our results partially confirm our hypothesis as the analysis of our data shows just a slight difference: the students in the experimental group obtain a slightly higher score than the control group (78.1% vs. 71.9%) in the achievement of content knowledge and its retention.

As for the second research question, i.e., if there are differences in long-term knowledge retention between experimental group and control group after eight months, the results largely confirm our hypothesis as the students experimenting active learning have greater success in improving and retaining linguistic competence. The comparative study of the groups establishes that the experimental group retain knowledge in the long term better than the group which has been receiving traditional teaching (70.6% vs. 54.25%), thus confirming that "when students interact with other students, having to explain and discuss other perspectives, this leads to greater understanding of the material to be learned" (Abu & Flowers, 1997, p. 2).

Our satisfaction with the development of this experience is justified in that it has fostered teacher planning, follow-up and control in order to reach the final objectives, that is, an improvement in language retention, and has also confirmed our hypotheses that active learning would have a positive effect on the students' knowledge retention. Our results confirm Rosetti & Nembhard's (1998) opinion that cooperative learning strategies motivate the students' interest and help their retention of key ideas by encouraging them to participate in discussion. In our experiment, this has also implied repetition of ideas, concepts and structures through reading, writing, listening, speaking, and simulating the real experience of being a teacher which have a positive effect on linguistic knowledge retention.

Admittedly the number of students participating in this study was small (32), but the results on the eight-month delayed test for long-term retention and the overall perception of the professors involved was so positive that we would have to align our first results along with those of Pate and Mateja who, back in 1979, called the results

[1] The diagnostic test used was one of the Oxford Placement Tests.

"exciting". An increase in the number of subjects and a strict control of the delayed time factor in future research, along with a study of variables such as the duration of the activity, differences among students with regard to initial linguistic level or GPA levels and the timing of the post-test to see to what degree, if at all, these variables affect retention, may, in the future, finally put to rest the question of long-term retention in active learning situations.

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