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Reflective Practices in Learning and Learning Transfer

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I was very much inspired by the recent contributions to New Chalk Talk from Ryan Derby-Talbot (volume 7, issues 9 and 10) concerning reflective practices in teaching and learning. Indeed, reflective practices can very much enhance the learning process not only because they could assist in assimilating, using and transferring information and knowledge gained, but more importantly, help the learner be aware of these processes. However, students' perception of the value of reflective practices in their learning is not always positive. This is primarily due, in my opinion, to the general conditioning of students, during schooling, to consider learning solely as information gain and retention.

Subjecting students to a learning paradigm shift, where the process of understanding and applying concepts, and the way to do this, are equally, if not more important than the gain of information, is a challenging task. It not only requires students to develop skills very different from ones they know and use for gaining and retaining information, but it also contradicts their perception of what "learning" is.

In Chemistry, learning generally occurs as a result of three processes: (1) the acquisition of principles and concepts, representing information gain and retention, (2) the ability to interpret and predict observations using the acquired information, and (3) the ability to carry out quantitative calculations. In this respect, reflective practices would be associated with processes (2) and (3).

Having taught one group of students in three courses (100, 200 and 300 level) over a period of three years, I have had the opportunity to observe the evolution of their perception of reflective practices. More importantly, I have found that these mirrored the transferability, from one course to the other, of skills and learning practices.

In the 100-level course, students expected to be passive recipients of knowledge. They anticipated the delivery of course concepts and principles together with the outcome of applying these to typical observations. In addition, they expected to be coached in the application of this information to quantitative problem solving using a limited number of templates. However, the course was conducted differently: students, through the use of concept tests[1] were urged to work out for themselves the application of gained principles and concepts to observations. Reluctant at first, they took to this activity, eventually identifying it as one which most helped them learn[2]. The application of gained information to solve numerical problems however remained a challenge throughout the course. Training students on solving typical problems using a limited number of templates would have been counterproductive. It would merely have allowed students to "reproduce standard answers" rather than "create answers to problems", as Derby-Talbot very effectively expressed it. This would subsequently very much limit the transfer of numerical problem solving skills beyond the course. An emphasis was therefore placed on the process of problem analysis and on the identification of the different possible solution methods. This was not what students

[1] These were first used in 1989 by Eric Mazur, Physics Professor at Harvard University, in teaching Newtonian Mechanics in his introductory physics class. The acclaim to their effectiveness rapidly spread, and now they are used in various disciplines as a tool for "peer instruction".

[2] Small Group Instructional Diagnosis carried out by the Center for Learning and Teaching for the 100-level chemistry course.

expected, and they demonstrated a persistent resistance to it. At the end of the semester, students commented about insufficient "traditional" coaching in problem solving.

Two semesters later, I had a number of these students in a 200-level course, entailing principles and concepts not covered in any prior courses, together with qualitative applications, and significant problem solving skills. Throughout the course, the application of gained information to observations ran smoothly. Moreover, students' perception of their skills in this regard was positive. On the other hand, quantitative problem solving skills were still in need of consolidation. This was recognized by the students, who, however, failed to realize that this resulted from their limited ability to analyze problems and "create answers". They still envisaged improvement in problem solving as dependent on solving large numbers of problems using a limited number of templates. To address this, problem analysis was further emphasized. This was carried out by abstracting, as much as possible, the application of the concept(s)/principle(s) of concern to the problem(s) at hand and using this to develop general conceptual methodologies for problem solving. This did reflect in minor but noticeable improvement in quantitative problem solving. However, students' perception of improvement did not match their expectations: at the end of the course, students were still not fully convinced of this approach, with comments reflecting an apprehension to the limited class time spent on "traditional" problem solving techniques.

I had the same students again in a 300-level course, where concepts and principles were more complex, their application to interpreting observations less straightforward, and problem solving more complex in analysis, but relatively simple in answers once the analysis was carried out successfully. Again, the application of information gained to qualitative interpretations of observations was carried out by students with little difficulty. However, quantitative problem solving skills still lagged behind, though to a lesser extent than in the 200-level course. Abstract analysis of course concepts and principles with regards to methods and limitations of application to quantitative problem solving was therefore carried out, with students being requested to extend this to assigned problems and examples as part of the solution. Initially, students found this challenging, but with continued engagement, and one-on-one follow up on my behalf (made possible by a small class size), they steadily improved in their performance. Very importantly they gradually became aware of the reason behind this improvement, and not only started valuing it, but became drawn into the process, growing enthusiastic (as much as one can get!) about problem solving.

On the one hand, reflecting on this group of students and the development of their learning skills over three years, it is clear that reflective practices are conducive to learning transfer. When students became aware of the gain/improvement of a skill, and the reasons behind this, the skill had a higher transferability to other courses. In this respect, the qualitative application of concepts and principles to the interpretation of observations transferred from the 100-level course, whereas quantitative problem solving lagged till the 300-level course.

On the other hand, undergoing a reflective activity myself about this process has assisted me in identifying how reflective practices can promote learning transfer. In this regard, I plan to revisit the design of course work for a number of my courses in order to more effectively incorporate reflective practices.

Share with us your experiences by contributing to the New Chalk Talk series, or by simply sending comments/suggestions to: aramadan@aucegypt.edu and/or aellozy@aucegypt.edu