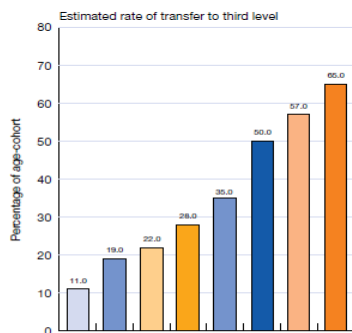


Retaining weaker science students: a pilot project in Chemistry at the University of Limerick

Introduction

In recent years there has been an exponential increase in the numbers of students in third level education; in the year 2007 50-55% of 17-18 year olds entered higher education, with the goal being to reach 72% by the year 2020.¹

Science courses at third level have significantly lower rates of non-completion (22.2%) in comparison to other courses such as Law (7.1%)²



Note:
The rate of transfer is estimated by taking the total annual intake to all full-time third-level colleges as a percentage of the estimated population at age 17. Some persons entering third level may have previously entered. Mature entrants and entrants from outside the State are also included.

Figure 1: Estimated Rate of transfer to 3rd level

Rationale for the Study

- In the first two years of the study of Science, in the University of Limerick, there are widely diverse classes, due to differing entry qualifications required from students.
- Entry into Irish third level institutions is based on the points accrued from 6 subjects, with an A1 grade at Leaving Certificate level (Terminal exam at the end of the Senior Cycle) earning 100 points and a D3 grade earning 45 points (on higher level papers).
- Many third level Science courses do not require students to have completed a relevant Science subject at Leaving Certificate level and have low entrance points. Those who have not done Science, in particular Chemistry, at Leaving Certificate level are often left behind, as they do not have an adequate grounding in the Science subjects.
- The 2nd. Year Chemistry class that we examined has a failure rate of 30-40% at the first sitting. It is taken by students from five different degree courses (A-E).
- The two courses 'A' and 'B' accounted for 95% of failures in the year 2007. One reason for this is that the entrance points for courses 'A' and 'B' are lower than those of the other courses taking the module.
- Studies evaluating initiatives to improve retention rates at third level noted that there was a need for learning-support programmes for students who were "weak" in critical areas.²
- The aim of this intervention project is to try to help a group of students, identified as "weak", to cope with introductory Chemistry courses.

Methodology

It was decided to run a 9-week intervention programme for students in the two courses 'A' and 'B', as they have been identified as weak.

- A diagnostic concept test was designed using chemical concept questions from chemical concept inventories.^{3,4}
- A sample diagnostic question is given below:

The circle on the left shows a magnified view of a very small portion of liquid water in a closed container.

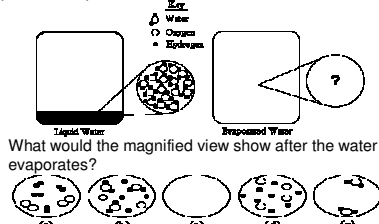


Figure 2: Concept test sample question

A unique feature of this intervention programme was to use the diagnostic tool to identify students' chemical misconceptions and to then use this to design the intervention programme to combat these misconceptions.

An attitude/chemical confidence test was also designed and administered to students in order to assess their confidence with chemical problems and concepts before and after the intervention programme.⁵

Results

Pre & Post Concept Test

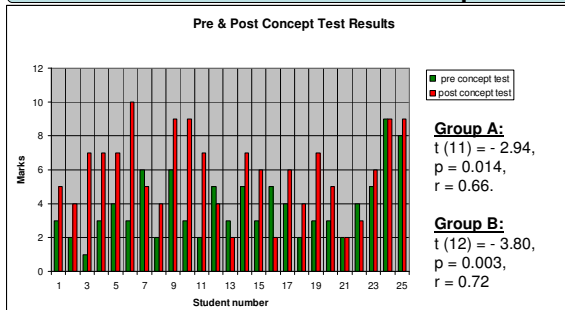


Figure 3: Comparison of Pre- and Post-test results for groups 'A' and 'B'

The results from this study have been positive

There was a significant difference between pre- and post-test in a positive direction (completed after students have undergone the 9 week intervention programme).

Pre & Post Confidence Test

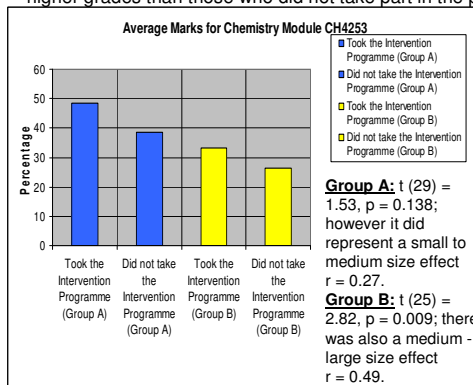
Students were given a pre-confidence/attitude test and a post-confidence/attitude test.

- Student's levels of confidence to understand key concepts of chemistry improved in both groups, in group 'A' in the pre-confidence test 50%, of respondents chose average and high, whereas in the post-confidence test 73% chose those two options. Group 'B' had their confidence levels increase from 50%, choosing average, to 56% choosing average and high.
- However, overall improvement in confidence levels in both groups was not significant, with group 'A' $p = 0.277$ and for group 'B' $p = 0.322$.

Chemistry Module Performance

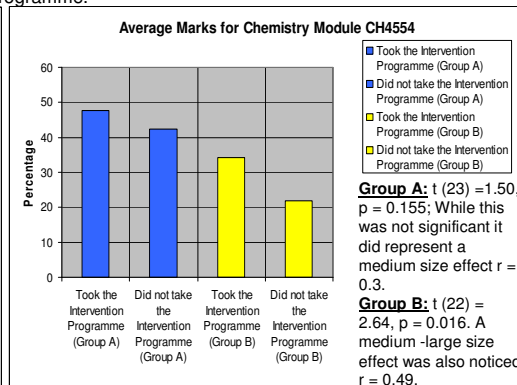
Students in groups 'A' and 'B' take two chemistry modules in their second year. It was decided to examine the continued performance of students in group 'A' and group 'B' in these modules, in order to determine if the intervention programme had any continued effect.

- In the first module CH4253, students who had taken part in the intervention programme performed better than their peers.
- In the second module CH4554 students who had taken part in the intervention programme were also seen to have higher grades than those who did not take part in the programme.



Group A: t (29) = 1.53, p = 0.138; however it did represent a small to medium size effect $r = 0.27$.
Group B: t (25) = 2.82, p = 0.009; there was also a medium - large size effect $r = 0.49$.

Figure 4: Comparison of module CH4253 results for students who took intervention course vs. students who did not take the intervention course.



Group A: t (23) = 1.50, p = 0.155; While this was not significant it did represent a medium size effect $r = 0.3$.
Group B: t (22) = 2.64, p = 0.016. A medium - large size effect was also noticed $r = 0.49$.

Figure 5: Comparison of module CH4554 results for students who took intervention course vs. students who did not take the intervention course.

Conclusions

- The results of this intervention programme are positive. The results of the pre- & post-concept test indicate an improvement in the students' chemical conceptions
- The chemistry examination results of students who undertook this programme are higher than those who didn't take the programme and there is a slight improvement in students' confidence after taking the programme.
- The unique factor of this intervention programme is to tailor tutorials to meet the students' needs through addressing basic chemical concepts and misconceptions.

Future Work

- Further study needs to take place in order to explore whether variables such as gender, points obtained in the Leaving Certificate, course attendance, previous study of Chemistry or Maths and over all college semester results have any effect on the results.
- To bring the programme back into students' first year of university in order to target their misconceptions earlier. The programme will also be extended over a longer time frame.

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