

Liziwe L Mugivhisa
Sefako Makgatho Health Sciences University

**Incorporation of small groups learning activities into Biology lectures to
enhance learning at a university in Pretoria, South Africa**

The aim of the study was to assess the effect of the incorporation of small groups learning activities into Biology lectures on the academic performance of the students.

The objectives of the study were then to:

- determine and compare the average test marks of the students before and after incorporating the small groups learning activities into Biology 2 lectures,
- investigate the perceptions of the students on the incorporation of small groups learning activities into the lectures before and after engaging in small groups learning activities.

Methods

The research design that was used in the study is the Design-Based Research Process (DBR). DBR is based on the theories in education and previous research with an intention of making improvements in the educational practice (Anderson and Shattuck, 2012). It has generally been agreed that DBR should be able to generate effective educational interventions and associated useful theories (Easterday et al., 2014).

Ethical clearance from the Sefako Makgatho Health Sciences University Ethics committee and consent from the Biology 2 students were sought before the commencement of the study. During the first semester, lectures were delivered without the incorporation of the small groups learning activities while in the second semester, small groups learning activities in the form of mind maps to summarise the lecture content were incorporated into the Biology 2 lectures. The small groups learning activities were incorporated into lectures only once a week and students were randomly selected into new groups of about 5 students per group each week for the

learning activities. Assessment tests were written by the students at the end of both the first and second semesters. The lectures were delivered by the researcher during both semesters. The inclusion criteria of the sample for the comparison of the test marks between the first and second semesters was 72 Biology 2 students who had attended a minimum of one lecture where there was incorporation of the small groups learning activities in the second semester.

A total of 126 Biology 2 students agreed to participate in the completion of the close-ended questionnaires for the assessment of the perceptions of the students on the incorporation of small groups learning activities into lectures at the beginning of semester 2 before there was incorporation of small groups learning activities. The participants included 29% males and 71% females with the majority (49%) of them being in the age range 18 – 20 years followed by 44.8% in the age group 21 – 23 years with the least number (5.6%) of the participants being in the 24 – 27 years age group. The majority of the participants (81.4%) were registered for Biology 2 for the first time while only 4.8% were repeating Biology 2. At the end of the second semester, only 41 Biology 2 students who had participated in small groups learning activities agreed to complete questionnaires to determine their experiences on the incorporation of small groups learning activities.

The study was quantitative and a paired sample t-test was used to compare the mean test scores of the Biology 2 students in the first and second semesters before and after the incorporation of the small groups learning activities respectively at $p < 0.05$. Analysis of Variance (ANOVA) was used to check if there was any significant difference between the mean test marks of the students who had engaged in different frequencies of engaging in the small groups learning activities ($p < 0.05$).

Outcomes

Table 1 shows the responses of the students on the incorporation of small groups learning activities into lectures. Slightly more than half (56.7%) of the participants had prior experience on small groups learning activities while 43.3% had never been exposed to small groups learning activities. The majority of the students (82.4%) preferred the incorporation of small groups learning activities in lectures whereas only 17.6% of the students preferred the teaching method of lectures only. Most of the

participants (77.2%) responded that small groups learning activities should be compulsory in all course modules while only 22.8% of the participants did not want the small groups learning activities to be compulsory in all course modules. Almost all the participants (98.4%) reported that small groups learning activities would improve their academic performance whereas only 1.6% responded that the small groups learning activities would not result in an improvement in their academic performance.

The majority of the participants (79%) preferred to have small groups learning activities at least once a week while 14% and 7% preferred small groups learning activities once a month and once a semester respectively (Figure 1). With regards to how long the small groups learning activities should be, 65% preferred to have small groups learning activities for a duration of between 15 and 30 minutes while 21% preferred the learning activities to last for more than 30 minutes (Figure 2). The least number of participants (14%) preferred small groups learning activities of less than 15 minutes.

Table 2 shows that the mean average test mark of $38.9\% \pm 16.4$ (mean% \pm standard deviation) in the first semester was significantly lower than the mean average test mark of $52.7\% \pm 15.7$ in the second semester when there was incorporation of small groups learning activities ($p < 0.05$). The range of the test marks in the first semester was 6% - 82% while in the second semester it was 13% - 85%. Only 22.2% of the students scored above the pass mark of 50% in the first semester while 59.7% of the students scored above the pass mark of 50% in the second semester. More students (8.3%) in the second semester compared to 4.2% in the first semester managed to score above a distinction mark of 75%. The mean test marks in the second semester as shown in Figure 3 were all significantly higher than the mean test marks in the second semester for all the frequencies (25%, 50%, 75% and 100%) of engagements in small groups learning activities ($p < 0.05$).

The responses of the students on the small groups learning activities at the end of the second semester after engaging in the small groups learning activities are represented in Table 3. The majority of the students (61.0%) agreed that group learning activities increased their memory followed by 24.3% and 14.6% who reported that they were neutral or strongly agreed respectively. Only 14.6% of the students strongly agreed that there was better understanding of the subject content after engaging in small groups learning activities while 62.0% agreed followed by 21.0% who were neutral.

The least number of students (2.4%) disagreed that there was better understanding of subject content after group learning activities. The students who reported that they strongly agreed that small groups learning activities were a good way to learn were 22.0% while the majority of the students (66.0%) of the students agreed that group learning activities were a good way to learn. However, 9.6% reported that they were neutral and 2.4% disagreed. The proportion of the students who strongly agreed that the small groups learning activities were fun and helpful was 22.0% while 46.3% agreed and 19.5% were neutral. Surprisingly, 7.3% and 4.9% of the students indicated that they disagreed and strongly disagreed respectively.

Discussion and Conclusion

The results of the majority of the students responding that the small groups learning activities improved their memory of the subject content in the present study are comparable with the results by Smith and Cardaciotto (2011) where the majority of the students reported more retention of course material. These results are also comparable with those in Towns and Grant (1997) where the students responded that cooperative learning activities in lectures contributed to an increase in their learning and comprehension of the content even though some students felt that learning activities resulted in less content being covered. According to Prince (2004), students tend to remember more content if there is an introduction of brief activities into the lectures. The preference of longer frequent active learning sessions and the response of the students that active learning is useful in the current study are in agreement with the results of Miller and Metz (2014) who showed that students found active learning to be a useful tool and preferred to have a larger percentage of the lecture time in basic sciences scheduled to learning activities.

A slight preference of working in groups by the students in the present study is in agreement with Oliveiral et al., (2006) where the majority (80%) of the students indicated that the learning activities which included discussion of the problems and group activities was useful to their learning. In a study by Yuretich (2003), the students indicated that even though they equally liked lectures, they considered the interactions with their peers and the lecturers as the most popular features of lectures. Also in Cavanagh (2011), students valued both traditional lectures and learning tasks in

cooperative learning but valued the varieties of learning activities more. The cooperative learning results in improved participation, understanding, motivation, and better academic performance of the students (Gull, 2015). The cooperative learning activities support the understanding of the students (Cavanagh, 2011). The engagement with peers supports and scaffolds learning of the students (Vygotsky, 1997) and individuals tend to learn more if they learn with others than when they learn alone (Michael, 2006). Group work has been found to augment academic achievement in several studies (Gull, 2015; Nichols, 2002; McMaster and Fuchs, 2002).

The results which showed a significant increase in the academic performance when there was an incorporation of small groups learning activities in the present study are comparable with the findings in Barrows and Tamblyn (1980) where the mean exam scores of the students who were taught using active learning were significantly higher than those who were taught in the manner which is teacher-centered like in the traditional lectures only method. Active learning is a student-centered pedagogical approach which focuses on the learner and what the learner does in a lecture (Michael, 2006).

It can be concluded that the results showed that the incorporation of small groups learning activities into lectures had a positive effect on the academic performance of the students and hence should be promoted in Biology lectures. It is however recommended that follow-up studies on small groups learning activities should be done on larger groups of students and over an extended period of time. Other factors such as the preparedness of the students and the presence or absence of other assessments around the time of writing tests which can have an impact on the performance of the students should also be investigated. Other learning activities besides summarising the content of the lectures into mind-maps such as answering questions or discussions could also be explored.

References

- Anderson, T. & Shattuck, J. (2012). Design-Based Research: A decade of progress in education research. *Educational Researcher*, 40(1): 16 – 25.
- Barrows, H. S. & Tamblyn, R. (1980). *Problem-Based Learning: An Approach to Medical Education*, Springer, New York.
- Cavanagh, M. (2011). Students' experiences of active engagement through cooperative learning activities in lectures. *Active Learning in Higher Education*, 12(1): 23 – 33.
- Easterday, M.W., Lewis, D.S. & Gerber, E.M. (2014). *Design-Based Research Process: Problems, Phases and Applications*. ICLS Proceedings.
- Gull, F. and Shehzad, S. (2015). Effects of cooperative learning on student's academic achievement. *Journal of Education and Learning*, 9(3): 246 -255.
- McMaster, K. & Fuchs, D. (2002). Effects of cooperative learning on the academic achievement of students with learning disabilities: An update of Tateyama-Sniezek's reviews. *Learning Disabilities Research Practice*, (17(2): 107-117.
- Michael, J. (2006). Where's the evidence that active learning works? *Advanced Physiology Education*, 30: 159-167.
- Miller, C.J. & Metz, M.J. (2014). A comparison of professional-level faculty and student perceptions of active learning, its current use, effectiveness and barriers. *Advanced Physiology Education*, 38: 246-252.
- Nichols, J. (2002). The effects of cooperative learning on student achievement and motivation in a high school Geometry class. *Contemporary Educational Psychology*, 21(4): 467-476. Doi:10.1006/ceps.1996.0031.
- Oliveiral, P.C., Oliveiral, C.G., De Souza, F. & Costa, N. (2006). Teaching strategies to promote active learning in higher education. *Current Development in Technology-Assisted Education @ FORMATEX 2006*.
- Prince, M. (2004). Does active learning work? A review of the research. *Journal of Engineering Education*, 93(3): 223 – 231.
- Smith, C. & Cardaciotto, L. (2011). Is Active Learning Like Broccoli? *Student*

Perceptions of Active Learning in Large Lecture Classes. *Journal of the Scholarship of Teaching and Learning*. 11.

Towns, M.H. & Grant, E.R. (1997). I believe I will go out of this class actually knowing something: Cooperative learning activities in physical chemistry. *Journal of Research in Science Teaching*, 34(8), 819–835.

Vygotsky, L.S. (1978). *Mind in society*. Cambridge, MA. Harvard University Press.

Yuretich, R.F. (2004). Encouraging critical thinking: Measuring skills in large introductory science classes. *Journal of College Science Teaching* 33(3): 40-46.

Table 1. Responses of students regarding small groups learning activities.

Response	The percentage of the participants (%)	
	Yes	No
Prior experience on small groups learning activities in lectures	43.3	56.7
Preference for lectures and small groups learning activities	82.4	17.6
Preference of working in small groups	51.6	48.4
Should small groups learning activities be compulsory in all course modules	77.2	22.8
Will small groups learning activities in lectures result in better academic performance or pass rate	98.4	1.6

Table 2. The performance of the Biology 2 students in the first and second semesters

Students' Marks	Semester 1 (before intervention) (%)	Semester 2 (after intervention) (%)
Mean test average	38.9±16.4	52.7±15.7
Minimum mark	6	13
Maximum mark	82	85
Students who scored above 50%	22.2	59.7

Students who scored below 50%	77.8	40.3
Number of students who scored more than 75%	4.2	8.3

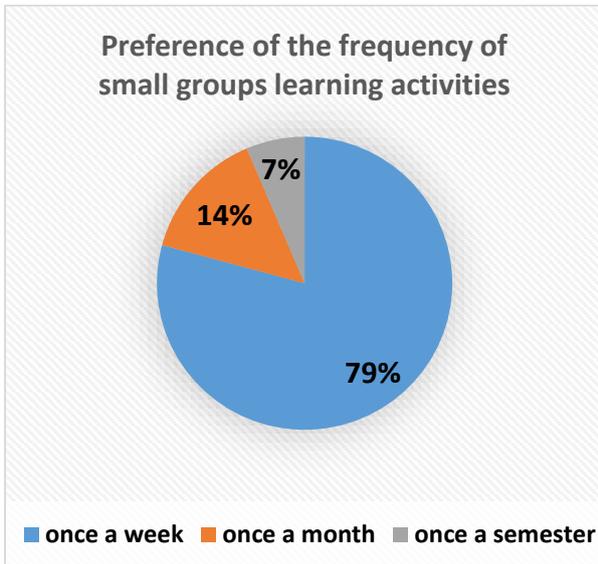


Figure 1. Responses on the how frequent the small groups learning activities should be.

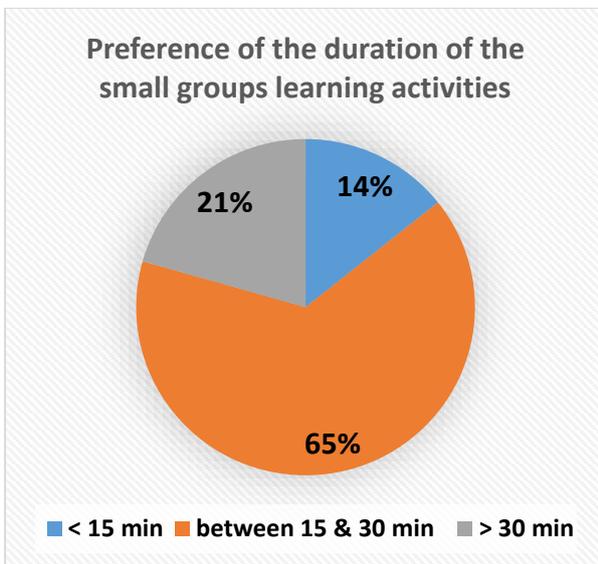


Figure 2. Responses on how long the small groups learning activities should be.

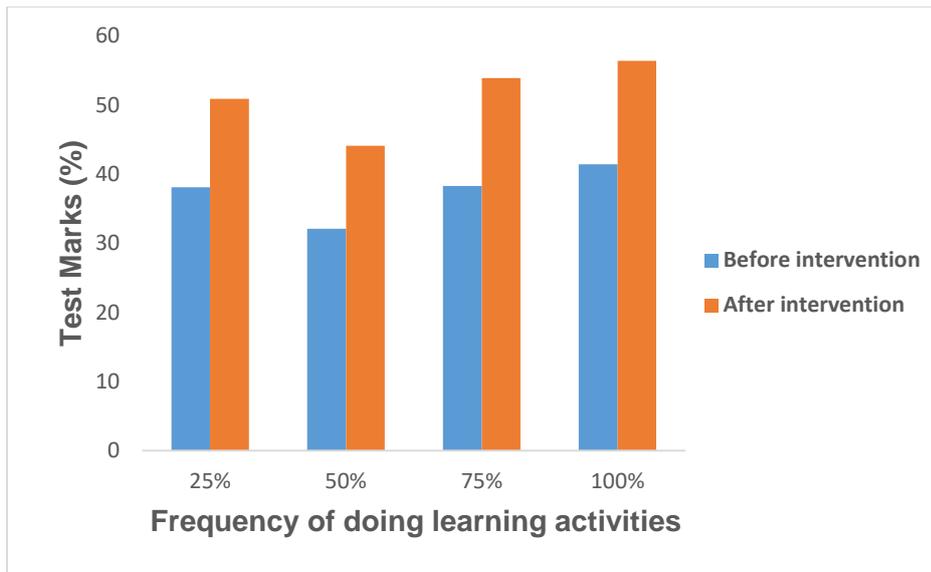


Figure 3. The test marks of students engaging in different frequencies of small groups learning activities.