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QUALITY ASSURANCE OF PEER-ASSISTED LEARNING BY MEASURING ACADEMIC PERFORMANCE OF HEALTH SCIENCES EXTENDED CURRICULUM STUDENTS

ABSTRACT

Peer-assisted learning (PAL) has numerous benefits in medical curricula. In the extended curriculum programme (ECP) at a university in South Africa, remedial interventions, such as same year/level PAL, were implemented to improve academic success. This article focuses on the measures to ensure the quality of PAL as an intervention for the academic under-preparedness of ECP students. After the midterm assessment results had been verified, the academically strongest ECP students were appointed as tutors (n=10) for the remainder of the student cohort (n=31). Structured, informal PAL activities were implemented as an academic intervention between consecutive assessments. Analysis of the pre- and post-intervention results showed a statistically significant difference for the whole study population as an increase of 6.1% was recorded in post-intervention results. Nine of the ten PAL groups showed an increase in the combined group results, the highest increase being 15.1%. Although the tutor group did not show a statistically significant difference between pre- and post-intervention results, 80% of the tutors experienced a positive effect on their academic progress by scoring higher post-intervention results. The results showed that same year/level PAL interventions can assist under-prepared ECP students to be academically successful with advantages for the tutors and tutees.

Keywords: *Peer-assisted learning; extended curriculum programme; PAL; ECP; academic performance; assessment.*

1. INTRODUCTION AND BACKGROUND

In South Africa, many universities have designed and implemented some form of foundational provision programmes to accommodate racially divided and previously educationally disadvantaged students (Boughey, 2005; Department of Education [DoE], 2001). To respond to this need (Boughey, 2005), the Faculty of Health and Environmental Sciences (FHES) at the Central University of Technology (CUT) in Bloemfontein, South Africa, also implemented such extended curriculum programmes.

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Through this programme, students could be equipped in advance to avoid under-preparedness (Slabbert & Friedrich-Nel, 2015) for a course they would otherwise not have been able to access. The main reason students were denied access was due to non-adherence to admission requirements for a specific qualification.

In the South African context, some students interested in attaining a higher education (HE) qualification lack the necessary knowledge, skills, values and attitudes to meet the minimum requirements for access to a higher education institution (Slabbert & Friedrich-Nel, 2015). In addition, poor science education offered during the basic education phase leads to many fallacies and academic misconceptions by school leavers and instil a degree of under-preparedness in some prospective students (Scott, 2009). The latter can be caused by many factors, such as institutional, human resource and financial challenges. The development of the foundation provision concept intended to redress accessibility of disadvantaged students who, due to inadequate access to quality education, might be at risk of not successfully completing their tertiary studies (DoE, 2006; Mabila *et al.,* 2006).

Various structural modifications to the foundation provision in the FHES at CUT were implemented since the first introduction as the context advancement programme (CAP) in 2004. This early form of foundation provision was converted to foundation programmes in 2006 and then to extended curriculum programmes (ECP) in 2007. These modifications were informed by a request from the former Department of Education to formally structure foundation provision within ministerial approved qualifications (DoE, 2006; Slabbert & Friedrich-Nel, 2015). Following a process of reflection on teaching philosophies, support structures, assessment models and teaching and learning activities in the ECP programme at CUT since first implementation, various remedial actions and academic interventions were developed and implemented. These interventions were aimed at improving the success rate of academic under-prepared students and to scaffold their learning to reach desired outcomes successfully; thus, focusing on provision of epistemological access and student academic development as the cornerstones of these initiatives (Boughey, 2005, 2010; Slabbert & Friedrich-Nel, 2015). This paper reports on one such intervention, namely peer-assisted Learning (PAL) by comparing pre- and post-intervention academic results of the 2017 ECP student cohort. This was done in order to establish if PAL could be a valuable interventional strategy to address the under-preparedness of many students, improve academic progress, assist students to succeed in their studies and quality-assure PAL intervention.

2. PEER-ASSISTED LEARNING IN CONTEXT

Historic philosophers such as Plato, Aristotle and Socrates were the first to employ the concept of PAL through questioning each other's ideas and statements (Herrmann-Werner *et al.,* 2017; Walberg, 1998). Development of the concept of PAL has ever since been an ongoing process and found its way into the curricula of many so-called "high risk" academic programmes, such as health sciences programmes (Dawson *et al.,* 2014; Meertens, 2016). A comprehensive definition for PAL was formulated by Capstick (2004) who collated the wider facets of this concept into the following:

> PAL is portrayed (when it works) as an open, informal, cooperative environment, in which students are able to set the agenda and raise their concerns, which is overseen by a trusted and approachable individual, and is of value in adjusting to university, understanding course material, enhancing the ability to do well in assessed work and building confidence (Capstick, 2004: 48).

A survey conducted in 2010 revealed that 25% of medical schools in the United States (US) have implemented PAL into their curricula to support students towards successful completion of their studies (Soriano, Blatt & Coplit, 2010). To shed light on the concept of PAL, Topping and Ehly (2001) indicated that PAL consists of various delivery methods, which include peer-tutoring, -modelling, -education, -counselling, -monitoring and -assessment. However, as emphasised by Hermann-Werner *et al.* (2017), irrespective of the mode of delivery, PAL is not intended to replace conventional teaching and learning, but should rather be designed as supplementary assistance focusing on improving the academic performance of students.

PAL refers to the informing processes employed to improve academic performance, whereas peer-tutoring, -mentoring and -learning refer to the specific procedures used for and aimed at the development of learning processes (Lincoln & McAllister, 1993). Two basic forms of PAL are applied, namely "same-year/level PAL" and "cross-year/level PAL". Same-year/level PAL implies that the tutors and tutees are in the same academic year or level and this type of learning focuses on mutual teaching and training (Blohm *et al.,* 2015; Weyrich *et al.,* 2008). Some researchers also classify this type of learning as peer-assisted learning schemes (PALS) (Meertens, 2016). According to Tai *et al*. (2016), PALS are implemented through informal, yet structured additional tutorials and practicals or study sessions that are less complicated to arrange, since the tutor and tutee share the same class timetable. On the other hand, for cross-year/level PAL more experienced (senior) students are requested to assist more junior students. This type of PAL primarily consists of discussions on broader academic topics such as study methods and non-academic issues such as language barriers, cultural differences, socioeconomic difficulties and adapting to university life (Blohm *et al*., 2015; Weyrich *et al*., 2008).

The problem identified prior to departure on this enquiry was the absence of a structured PAL strategy in an undergraduate health sciences programme. This shortcoming had a negative influence on students' academic performance and the development of skills and competencies towards successful completion of their studies. To address this problem, the researchers implemented, as part of an action research project, informal, yet structured same-year/level PAL activities in the 2017 ECP student cohort in the FHES at CUT, and analysed the pre- and post-intervention results. The question set to guide the activities in the investigation was: "What is the effect of a structured PAL intervention on the academic performance of ECP students, and will this intervention assist the under-prepared student to be academically successful and thus improve articulation into the consecutive mainstream programmes in the FHES?"

3. METHODS

3.1 Study design

The study design was based on the principles of action research. Action research in the educational environment is beneficial since it can combine the use of different research designs, such as descriptive and exploratory designs. An action research design was adopted for this investigation because it aims to address a particular challenge and allows for the proposal of guidelines for improvement of practice (Denscombe, 2010). The mode of enquiry to accumulate the data for the phase of the study reported in this article was quantitative to facilitate objective measurements and statistical analysis of the data.

3.2 Research process

All registered students from four ECP programmes in the FHES were included in the study. These programmes were the Bachelor of Radiography in Diagnostics, National Diploma in Environmental Health, National Diploma in Clinical Technology and Diploma in Biomedical Technology, which accounted for a total of 41 registered students. From the total of 41 registered ECP students, 10 academically strong students were identified to act as tutors during the second semester. These students were purposively sampled according to the marks (ranging between 70% and 80%) that they had obtained in the first semester's assessments for Physiology, which is a year module. The Physiology module was selected because ECP students from all the aforementioned learning programmes in the faculty were enrolled for this module. The remaining participants (n=31) were randomly placed in groups of four to five students, including the selected tutor for each group. Since PAL is an academic intervention strategy, no control groups were included to adhere to the inclusivity rules of the FHES. However, to have some degree of control during the analysis of the results, all variables such as pre-class reading/activities, interactive facilitation of learning units, formal feedback, reflection sessions and the assessment method were kept the same to allow for comparison of the pre-intervention and post-intervention results.

Similar to semester one (pre-intervention) and according to normal practice in the programme, formal feedback sessions took place after each of the four scheduled assessment activities in semester two. All 41 students attended these feedback sessions. After each formal feedback session, class time was scheduled for a structured PAL intervention activity (four PAL activities in total). The activities were designed by the researcher (also the facilitator of the Physiology module) to address problem areas identified during the grading of the individual assessments conducted in semester two. Before each PAL activity, a structured information session was held with the tutors. During these sessions, which varied between 40 and 60 minutes, the facilitator of the module guided the tutors on the problem areas identified, which mostly included comprehension of difficult course content, the lack of skills to link the assessment question with the learning outcomes and assessment criteria, and/or understanding some basic scientific principles, such as conversion of units during calculations. These problem areas intended to be addressed by a specific PAL activity were highlighted. The tutors were requested to complete the PAL activity with their tutees, paying specific attention to these areas. During the sessions scheduled for the PAL activities, the facilitator was present and listened actively, while roaming the venue, checking whether information/content was correctly conveyed to the tutees and intervened when required to guide or when requested by one of the tutors.

3.3 Data capturing and analysis

All results (pre- and post-intervention) analysed in this study were verified in accordance with the CUT assessment policy. After each assessment, formal feedback was given to the students (study population) and then marks were captured on an Excel spreadsheet before being transferred to the official database for verification by the moderator, head of department (HOD) and the student cohort. Pre- and post-intervention results included in this study comprised the same amount of assessment events and the same weighting towards the final assessment mark. Analysis of the respective results was done by means of Statistical Analysis Software (SAS) Version 9.2 (SAS Institute Inc.; Cary, NC).

Descriptive statistics (frequencies and percentages) were calculated for categorical data and numerical data were analysed according to means and standard deviations. The differences in pre- and post-intervention results with its respective mean differences were reported for tutors, tutees and the total group. Furthermore, 95% confidence intervals (CI) were calculated for the mean differences for tutors, tutees and the total group. The dependent T-test was used to investigate the significance of the mean differences with a significance level (α) of 0.05.

3.4 Ethical considerations

The research formed part of a bigger action research project on PAL (UFS-HSD 2018/0628/2808) in the FHES that was approved by the Health Sciences Research Ethics Committee (HSREC) at the University of the Free State (UFS). Permission to conduct the study was granted by CUT and the FHES. Informed consent was obtained from the participating students and confidentiality of personal information was confirmed. Participation was voluntary and students were informed that they may withdraw from the study without consequences.

4. RESULTS AND DISCUSSION

All 41 students participated in all the assessments in both pre- and post-intervention phases of the study. The difference in percentage between pre- and post-intervention results for each individual participant is displayed in Figure 1. The figure illustrates the average percentage change in results obtained during the pre- and post-intervention assessments for the whole study population. Twenty-eight students (68.3%) achieved an increase in their average assessment results, 12 students (29.3%) experienced a decrease in their average results and one student (2.4%) showed no change from pre- to post-intervention. The range noted in the average change of results when the whole study population's pre- and post-intervention results were compared, was between an increase of 40% and a decrease of 24.5% (Figure 1). An average increase was calculated at 13.1% for those students who yielded higher post-intervention results and an average decrease of 10.8% was noted in the student group who experienced a decrease. When taking the whole study population (n=41) into consideration, the observed mean difference between the pre- and post-intervention results was 6.1% (CI [1.68%, 10.49%] and standard deviation [SD] 13.94), as shown in Table 1. These changes reflected a statistically significant difference with t (40) = 2.67 and p=0.0079.

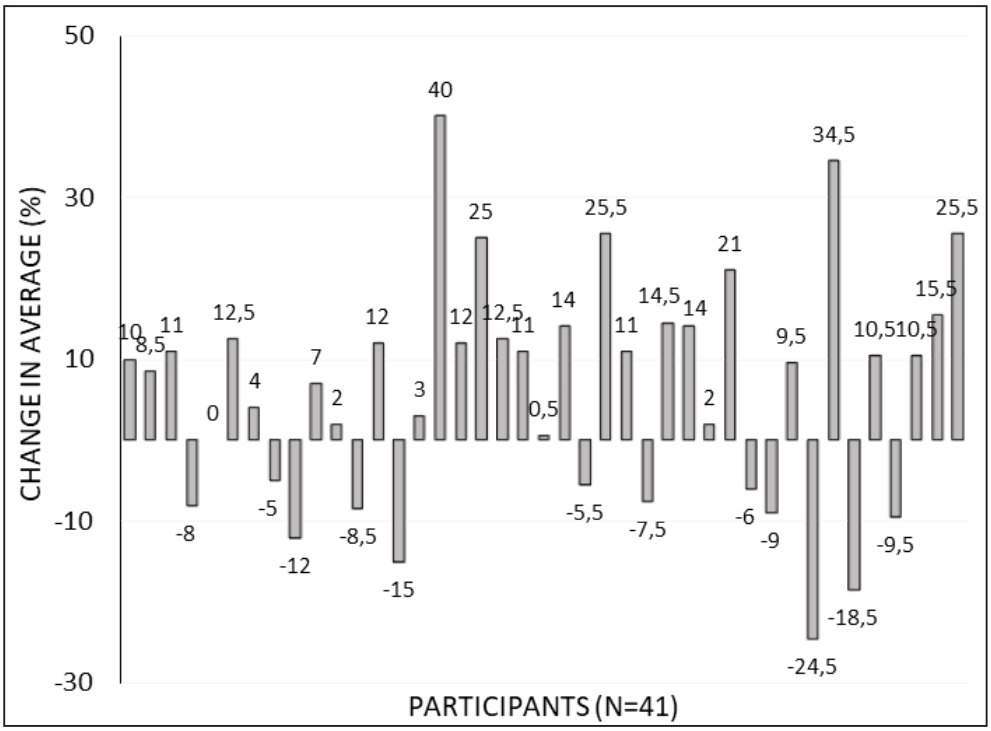

Figure 1: Differences between pre- and post-intervention results for the 2017 ECP cohort (n=41)

The effect of PAL on student performance has been reported with most studies focusing on three major outcome areas that include (i) how effective PAL is on tutor performance; (ii) how effective PAL is on tutee performance and (iii) whether students subjected to PAL perform comparable to those subjected to normal faculty teaching and learning (Batchelder *et al.,* 2010; Herrmann-Werner *et al.,* 2017; Hughes, Jiwaji *et al.,* 2010). The results from these studies also yielded mixed outcomes, similar to the current study's results. With 29.3% of the current study population yielding lower post-intervention results and 2.4% showing no impact of PAL on assessment outcomes, these findings were consistent with studies by Batchelder *et al*. (2010) and Hughes *et al*. (2010), who reported no impact of PAL on student performance. However, most of our study's population (68.3%) did benefit from this intervention, which corresponded with results of studies on PAL in medical curricula reporting an increase in student academic performance in objective simulated clinical evaluations (OSCEs) (Burke *et al.,* 2007; Jünger *et al.,* 2005; Weyrich *et al.,* 2009) and increased clinical skills or knowledge in gastroenterology and haematology of students who participated in PAL activities (Knobe *et al.,* 2010; Peets *et al.,* 2009).

Table 1. Change in average results for pre- and post-PAL intervention for all 10 student groups.

Group number	Change in average results for pre- and post-PAL intervention (%)					
	Tutor results (%)			Combined group results (tutors & tutees) (%)		
	Pre-intervention	Post-intervention	Difference	Pre-intervention	Post-intervention	Difference
1	68.5	78.5	10.0	61.125	66.5	5.375
2	73.0	73.0	0	62.5	65.25	2.875
3	68.5	56.5	12.0	55.25	52.37	–2.875
4	80.5	92.5	12.0	55.5	65.5	10.0
5	74.5	86.5	12.0	57.125	72.25	15.125
6	79.5	80.0	0.5	51.5	60.125	8.625
7	69.5	80.5	11.0	60.0	68.0	8.0
8	69.0	71.0	2.0	59.25	61.25	2.0
9	65.5	75.0	9.5	50.75	51.0	0.25
10	66.5	77.0	10.5	53.6	64.1	10.5
AVG	**71.5**	**77.0**	**5.6**	**56.6**	**62. 7**	**6.1**
SD	**5.22**	**9.63**	**7.86**	**12.60**	**15.47**	**13.94**

AVG = average; SD = standard deviation.

4.1 Effectiveness of PAL for tutees

The differences noted between the pre- and post-intervention results for all the tutors and their respective average group results are captured in Table 1. This table provides a holistic view on how each PAL group's tutor and their combined average tutees' academic performance was influenced by this intervention. Pre- and post-intervention average assessment results for the 10 different PAL groups' individual group members are illustrated in Figures 2–11. Nine PAL groups (90.0%) delivered an increased combined average result after the implementation of this intervention, while one group (10.0%) showed a decrease in post-intervention results. On average, a 6.1% difference between pre- and post-intervention results for the whole population (all groups) was noted, with the highest group increase recorded as 15.1% and the biggest group decrease as -2.9% (Table 1). Eight tutors (80.0%) experienced a positive effect on their own academic progress by scoring higher post-interventional results, one tutor (10.0%) delivered no change and another tutor (10.0%) experienced a decrease in post-intervention results. The average difference noted between pre- and post-intervention results for all tutors was an increase of 5.6%, with the highest increase for two tutors at 12.0% and the biggest decrease for one tutor recorded at -12% (Table 1).

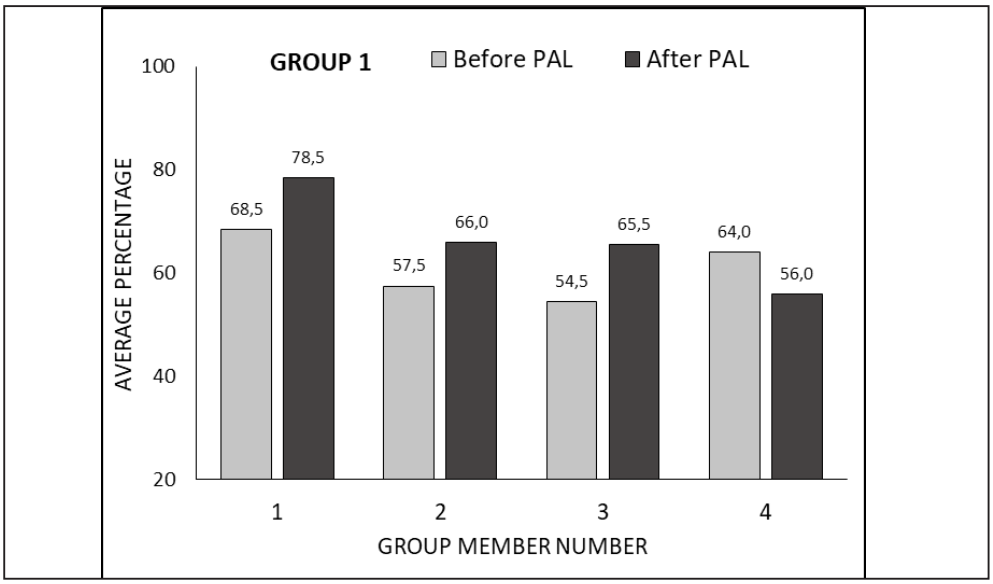

Figure 2: Pre- and post-intervention results for PAL Group 1

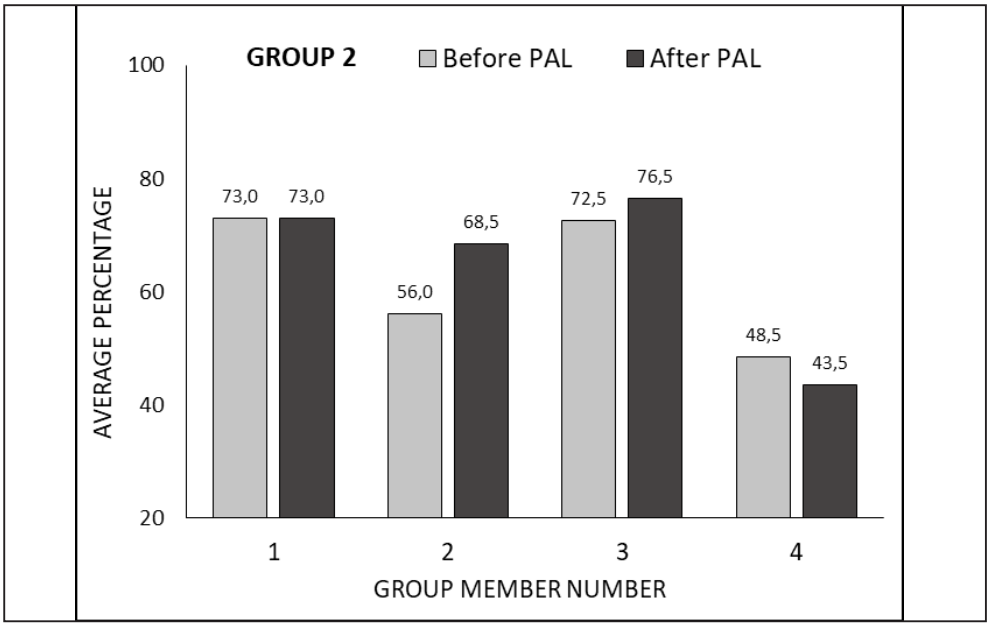

Figure 3: Pre- and post-intervention results for PAL Group 2

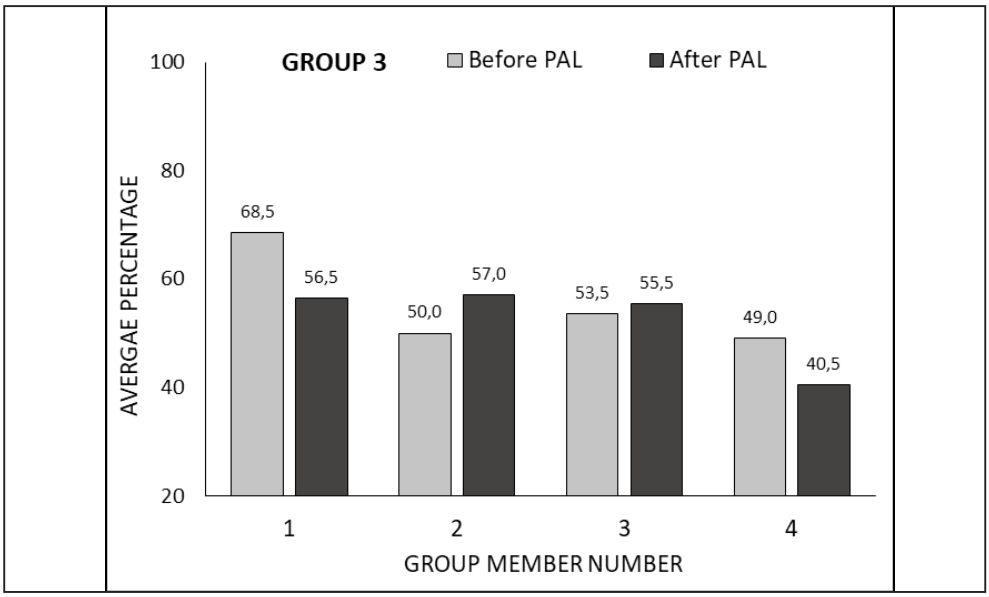

Figure 4: Pre- and post-intervention results for PAL Group 3

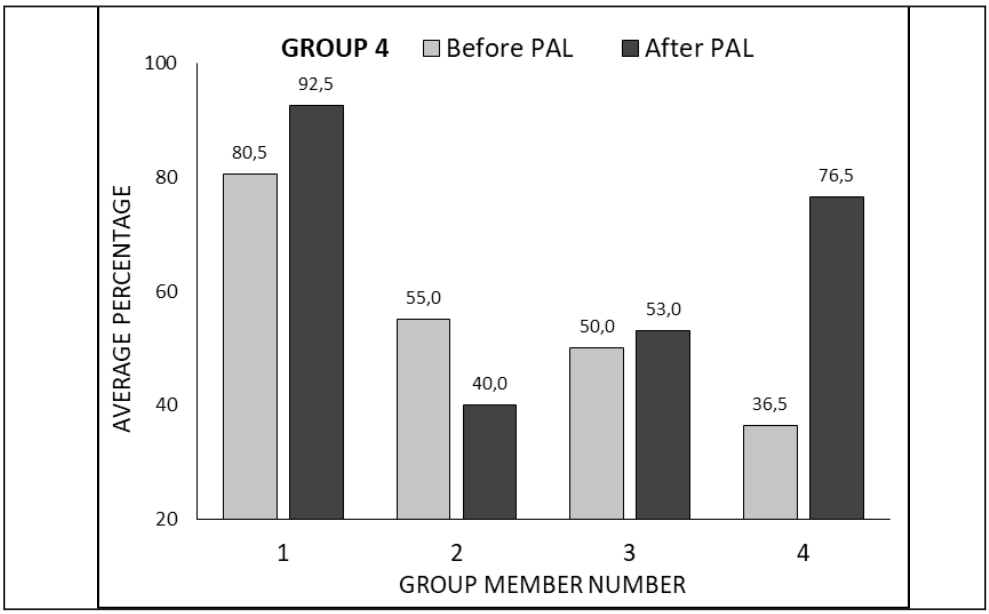

Figure 5: Pre- and post-intervention results for PAL Group 4

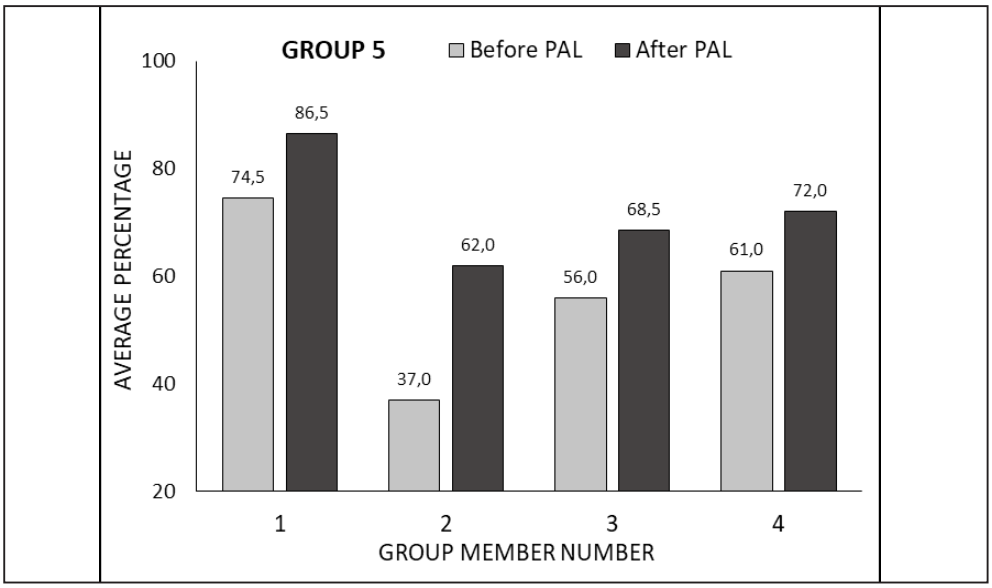

Figure 6: Pre- and post-intervention results for PAL Group 5

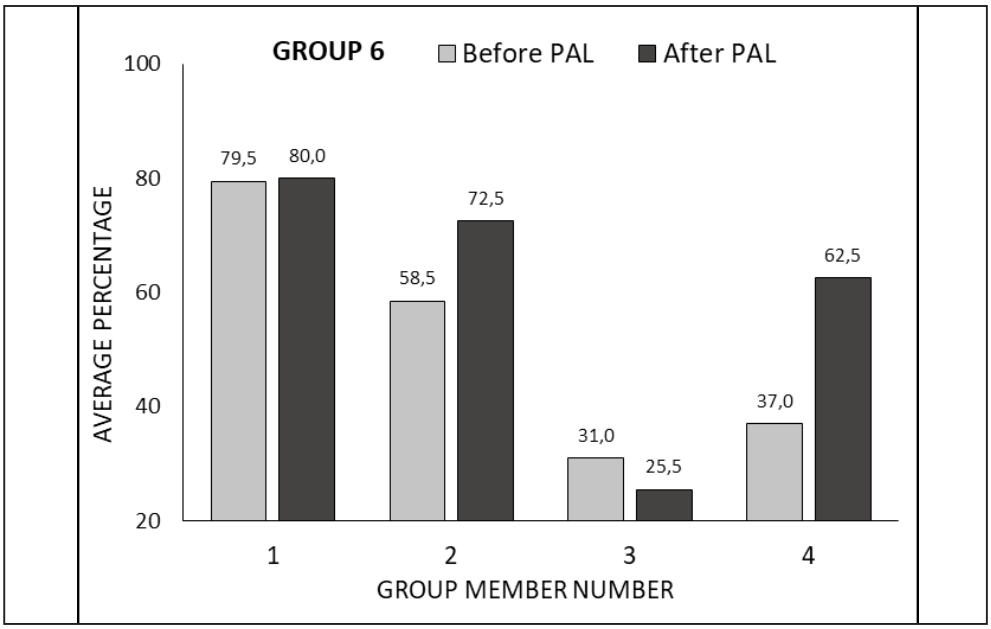

Figure 7: Pre- and post-intervention results for PAL Group 6

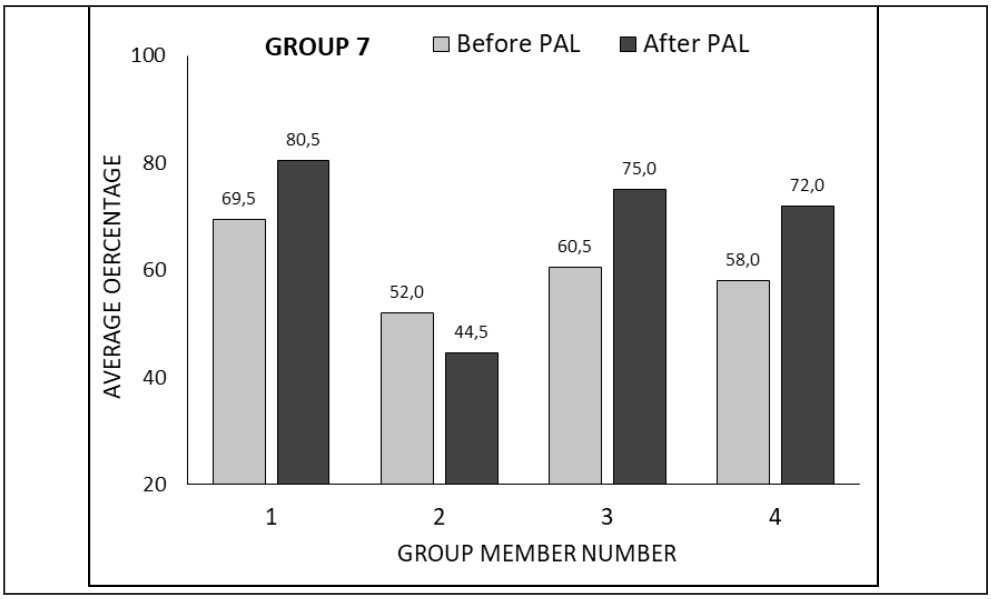

Figure 8: Pre- and post-intervention results for PAL Group 7

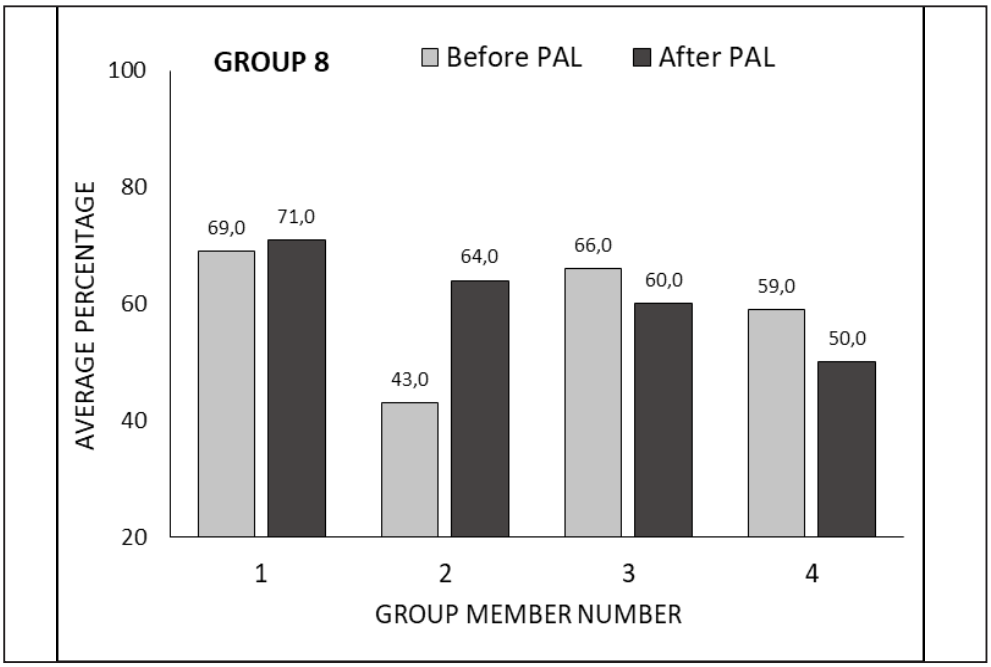

Figure 9: Pre- and post-intervention results for PAL Group 8

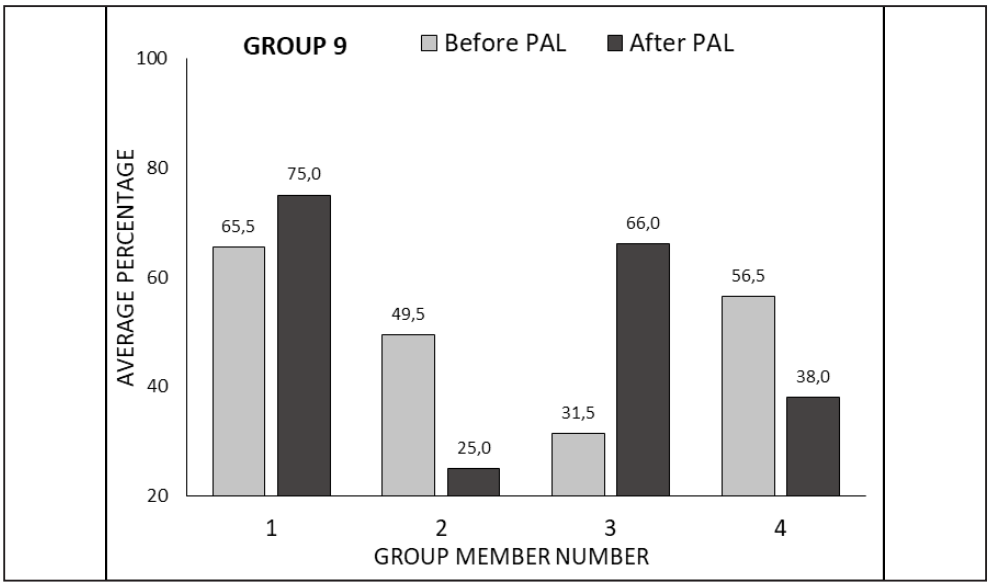

Figure 10: Pre- and post-intervention results for PAL Group 9

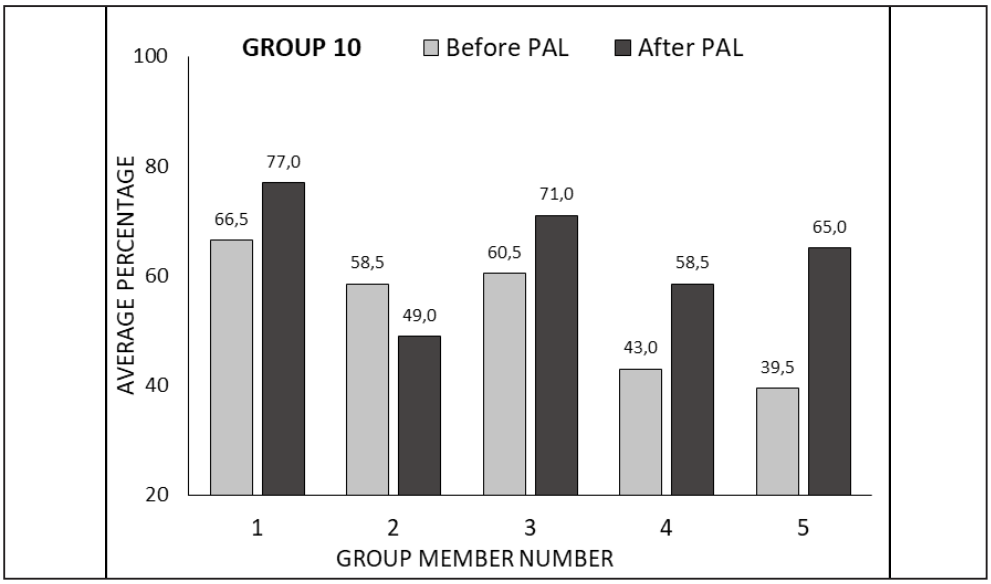

Figure 11: Pre- and post-intervention results for PAL Group 10

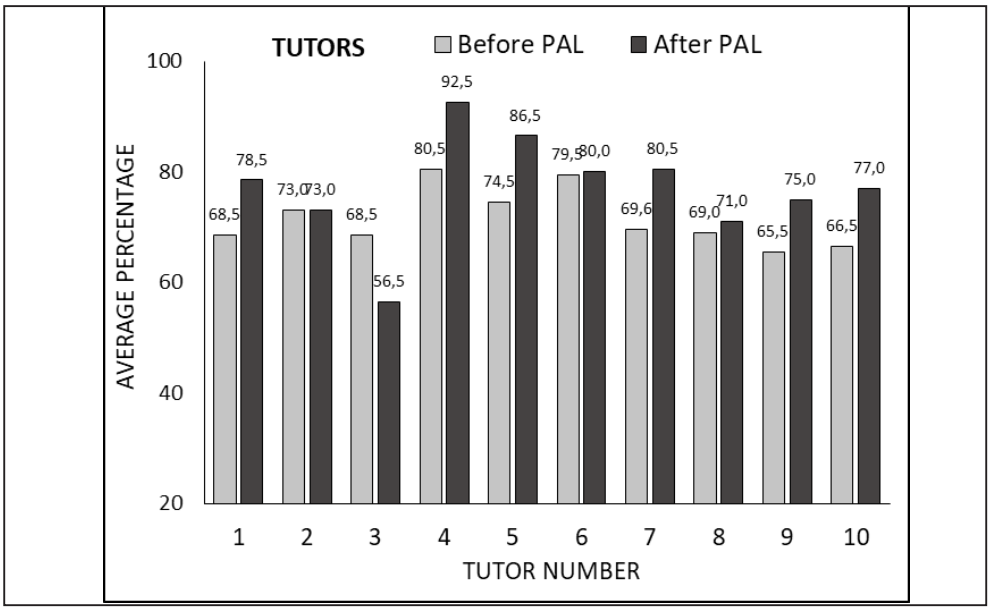

Figure 12: Pre- and post-intervention results for group of tutors

Literature on academic benefits of PAL for tutees are contradicting. A scoping review by Williams and Reddy (2016) reported on randomised studies recording significantly higher academic performance in assessment of PAL tutees. The authors also recorded no difference or in some cases a reduced academic performance for the tutees (Williams & Reddy, 2016). These contradicting outcomes were not noted in the current study since a statistically significant difference was calculated between the pre- and post-intervention results for the tutees. The calculated mean difference between the pre- and post-intervention results for this group was 6.3% CI [0.59, 11.96], showing a statistically significant difference with t (30) = 2.25 and p=0.0318. The majority of the 2017 ECP student cohort were tutees (n=31; 75.6%) who benefited academically from this intervention. It could be argued that tutors had a better understanding of the various learning difficulties experienced by the tutees and that tutors might have been in a better position to assess tutees' existing knowledge than faculty staff (Kassab *et al.*, 2005).

Assessing existing knowledge and then modifying it is paramount for learning to take place. Therefore, the close difference between the knowledge networks of tutors and tutees could have increased the potential for identifying and ultimately resolving academic challenges – as postulated by the theory of "cognitive congruence", which entails harmony and internal consistency arising from compatibility among students' attitudes, behaviour, beliefs and/or knowledge (Bulte *et al.,* 2007; Cornwall, 1979; Lockspeiser *et al.,* 2008; Ten Cate & Durning, 2007). Furthermore, for learning to take place, a certain difference in cognitive "space" between existing and new knowledge is required, as underpinned by Vygotsky's "zone of proximal development", which points to the difference between what a learner can do without help and what s/he cannot do without assistance (Vygotsky, 1978). This space was probably better sensed by the same-year/level tutors (smaller difference in cognitive space) in the current study than by the lecturer where the cognitive space is assumed to be bigger, given the noted increase in tutee post-intervention results (Topping, 2005).

Participating in PAL activities have the added advantage for tutees to express learning challenges in their own mother tongue, which is not always possible in the interaction between student and lecturer. The atmosphere during same year/level PAL activities is also less tense, "mistake forgiving" and cooperative in nature and facilitates cognitive closeness between tutors and tutees. This in turn provides group members with a better stance of communicating at a familiar cognitive level (Bulte *et al*., 2007). Since the academic module included in this study (Physiology) requires critical thinking and some level of clinical reasoning from students, PAL activities might have facilitated deeper learning processes in the tutors and tutees, such as mutual problem solving, reasoning skills and brain-storming. This deep learning could also have been an explanation for the overall positive increase noted in the study population's post-intervention results (Lincoln & McAllister, 1993).

4.2 Effectiveness of PAL for tutors

The difference between the pre- (M=71.5, SD=5.22) and post-intervention (M=77.0, SD=9.63) mean results for the tutor group was also investigated, as shown in Figure 12. The observed difference between means was 5.6% CI [-0.12, 11.12], although this difference was not statically significant, with t (9) = 2.21 and p=0.0541. Although a non-significant difference was recorded with a p-value slightly higher than 0.05, the majority of tutors (80.0%) did generate an increase in their post-intervention results, confirming the PAL intervention to be a strategy that can increase academic progress. However, one of the tutors obtained an average of 12% less during the post-intervention assessments. Pursuing the possible personal reasons for this relapse in academic performance was beyond the scope of the study. Coincidentally, this tutor's group was also the only group that did not show an increase in their combined average post-intervention results. According to the literature, optimal tutor-tutee pairing should ideally shuffle regularly to encourage learning from various students in the classroom setup and taking up the responsibility of a tutor should also take turns (Kassab *et al.*, 2005). This suggested pairing, however, was not applied in this study, which might have caused non-optimal group dynamics in this particular group.

Positive outcomes of tutoring on various learning aspects, such as higher assessment results after acting as a tutor and better communication skills development, were also noted by Knobe *et al*. (2010), Solomon and Crowe (2001), and Dandavino, Snell and Wiseman (2007). It could therefore be argued that acting as a tutor entails a substantial amount of verbalisation (during preparation and actual PAL activity), which supplies the tutor with an alternative approach to the module discourse and mastering of the content. Pre-determined learning goals established by the tutor for his/her tutees during the structured pre-PAL sessions with the facilitator, also enable tutors to make learning more meaningful (Schmidt, 1989; Ten Cate & Durning, 2007). These recorded academic benefits of tutoring can be substantiated by paradigms (such as the self-determination theory and cognitive dissonance), which explain that acting as an expert in a certain field, allows tutors to feel like real experts (Festinger, Riecken & Schachter, 1956; Ryan & Deci, 2000).

The higher post-intervention results of tutor assessments noted in the current study could be explained by acknowledging the possible effect that "teaching your peer"' and "assessment" have in common – it drives learning (Ten Cate & Durning, 2007). The famous French moralist, Joseph Joubert said: "To teach is to learn twice" (Snell, 2011). Tutors attended a structured session with the facilitator before every PAL activity, which, in addition to the more time spent on preparing for the actual activity, enabled them to retain more knowledge on the module

content than the tutees (Peets *et al*., 2009). Some researchers have been of the opinion that the preparation done by tutors supply better knowledge-gaining skills as comprehension of teaching others and the underlying principles of teaching become clear (Tang, Hernandez & Adams, 2004). This in turn makes tutors in some cases better learners themselves, as teaching peers seems to nurture internal motivation to study course material with more determination than to simply attend the same informative classes (Bulte *et al*., 2007; Dandavino *et al*., 2007; Ryan & Deci, 2000), which was also evident from this study's results.

During the actual tutor-tutee contact and the structural pre-PAL sessions, the researcher noted that tutors exhibited more self-confidence as the sessions continued throughout the second semester. Tutors also became increasingly more comfortable posing questions to the facilitator and acknowledging their own academic shortcomings as the intervention progressed. This phenomenon has also been noted by Hudson and Tonkin (2008).

5. CONCLUSION

We reported on the quantitative impact of a same year/level structured PAL intervention on the academic performance of students in an ECP undergraduate health sciences programme. Findings from the study highlighted several academic and developmental advantages for the majority of the tutees and tutors, although not all participants benefited from the intervention. It was also evident from the results that the use of an informal, yet structured same-year/level PAL intervention in the classroom can assist the under-prepared ECP student to be academically successful, and thus improve articulation into the consecutive mainstream programmes in the FHES. Important to note, however, is that although PAL was found to be an effective academic intervention fostering remedial action to address educationally disadvantaged students' academic success, it should not be considered as a replacement for conventional teaching, irrespective of previously documented economic advantages (Capstick, 2004).

Although the scope of this paper was focused on the quantitative effect of PAL on academic performance, additional research is warranted on the qualitative aspects such as students' experience of the intervention and their self-reported perception regarding its impact on their academic performance, motivation and understanding of subject content. Future research should also focus on optimising the ultimate student support offered by PAL interventions by exploring the links between academic success and different student learning styles, self-esteem and PAL group dynamics.

6. ACKNOWLEDGEMENTS

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7. DECLARATION OF INTEREST

The authors do not have any conflict of interests to declare.

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