The Peer Teaching/ Learning Experience Programme: An Analysis of Students' Feedback

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Abstract

Freire's views on the dialogical nature of teaching and learning inspired a group of postgraduate students who had previously been involved in facilitating Supplemental Instruction (SI) but observed low student participation. After reflecting on their own experiences the group initiated a discussion forum for first-year biology students with the aim of transforming student learning from a relatively passive experience to an active, engaging process. In contrast to the SI programme Peer Teaching/Learning Experience Programme (PTLEP) sessions were characterised by large student numbers per session (100-300), a much longer duration (up to 3 hours), and they were conducted at weekends or after hours. Furthermore sessions were offered only close to exams and tests with two sessions per test and three sessions per exam. In the PTLEP tutorials, facilitators guide the process and make comments, but only after the students themselves have made suggestions on how to answer questions correctly. Records from the attendance registers, evaluation questionnaires given to a sample of students attending the programme, and video recordings of sessions revealed that PTLEP increased attendance and active participation of the attending students. These multi-layered peer interactions mitigated the effects of the high student-lecturer-ratios observed at the University of KwaZulu-Natal and offered pedagogical benefits as competition was decreased among students and cooperation, motivation, self-confidence and self-esteem were increased. Contrary to the belief that peer teaching should be limited to peer discussion in small groups,

the students' responses to a set of questionnaires and their participation in academic workshops indicate that, in an African context, peer education involving large numbers of students creates a motivating learning environment.

Keywords: Peer Teaching, students' motivation, engagement, peer tutoring, pedagogy, collaboration

1. Introduction

Mackenzie, Evans and Jones (1970) stated that a peer student is often the least recognised, the least used and yet, the most important of all the resources that may be available to any student (Goldschmid & Goldschmid 1976; Treisman 1985). After observing the studying habits of Black American students, and comparing them with the highly successful Asian American students, Treisman (1985) hypothesized that poor performances of Black American was due to their tendencies of studying in isolation. He developed a mathematics workshop, a highly successful professional development programme at the University of California, Berkley (U.S.A.), to address such academic isolation in Black students. He then created a study network for Black American students, organising them into study groups of 5-7, after observing that it was highly successful for Asian American students. Each group was assisted by a graduate student as facilitator to stimulate discussion and to answer questions. The programme improved academic performance and retention of Black American students (Drane *et al.* 2005; Fullilove & Treisman 1990; Treisman 1985). Since then, there has been a proliferation of workshop style programmes in mathematics and other science subjects including chemistry and biology. The positive student evaluations of these programmes suggested that the workshop approach has the potential for improving the performances and retention of Black American students in science and engineering (Drane *et al.* 2005). Since the South African universities face similar challenges of retention (Letseka & Mail 2008), this type of study support might help in overcoming some of challenges faced by disadvantaged Black students in South Africa.

There have been challenges to retain and graduate disadvantaged students at South African Universities. In 1996, a proposal to transform Higher Education in South Africa was developed by the National Commission on Higher Education (Mdepa & Tshiwula 2012). The aim of this new education system was to increase the student population or enrolment of previously excluded groups in order to address equity and promote development (Mdepa & Tshiwula 2012; Badat 2009). It also aimed at increasing diversity and this required flexibility with regards to enrolment of students to Universities (Mdepa & Tshiwula 2012; Badat 2009; Van der Flier, Thijs & Zaaiman 2003). Under the new education system universities were required to enroll more Black students in order to reflect more accurately the demographic composition of the South African population (Mdepa & Tshiwula 2012).

Universities in South Africa recruit students based on their school performance (Van der Flier, Thijs & Zaaiman 2003). In Science for example, students are expected to obtain a matriculation aggregate score of 60 to 69 percent as this is regarded as necessary for a student to have an adequate chance to succeed in the university (Van der Flier, Thijs & Zaaiman 2003). It is widely acknowledged that the majority of Black students in South Africa come from poorly resourced schools, where there are often inadequate facilities, lack of sufficiently qualified teachers, and little or no career guidance (Mdepa & Tshiwula 2012; Taylor 2009). In addition, parents, siblings or closer relatives of these students usually do not have university experiences themselves and in most cases these students are the first generation to be admitted into the university (Mdepa & Tshiwula 2012). Under the new education system, in order to expand/increase the numbers of the previously disadvantaged students, universities had to change their recruiting standards and some of the Black students were admitted based on their potential rather than their performance at secondary schools (Mdepa & Tshiwula 2012; Badat 2009; Van der Flier 2003). As an example of such increased enrolment, in 1993, there were 473000 students of which 21% were Black. Between 1993 and 2008 the number of Black South African students increased by 503% from 99320 in 1993 to 599541 students in 2008 (Mdepa & Tshiwula 2012; Badat 2009).

While enrolment to higher Education by Black South African students has undoubtedly increased, the outcome in terms of successful

graduation and qualification of many of these students has been a big concern. In a cohort study by Letseka and Maile (2008), among 120000 students who enrolled for higher education, 30% dropped out in their first year and further 20% in their second and third year. While only 22% completed their three year degrees on time, 28% more were still in the system. There have been concerns over the high rate of Black South African students repeating and dropping out (Letseka & Maile 2008). The issue of high failure rate which is as high as 80% in some universities is of great concern, especially because the drop-out rate costs National Treasury R 4.5 Billion in grants and subsidies which are given to students in Higher Education and such students are never going to qualify for a degree (Letseka & Maile 2008). It seems that increasing enrolment alone has not been a sustainable way to increase the number of highly qualified Black South African students. Poor performance, high attrition and low graduation rates of highly talented but disadvantaged students (due to their previous schooling experience) resulted in the loss of some of the potentially gifted students from sciences and the loss of future leaders of the scientific community. There have been concerns that the high failure rate is a threat to the future of South Africa, especially because the country has limited resources, and special skills shortages (Letseka & Maile 2008). Universities are struggling to solve the problem of high enrolment numbers, high dropout rates and decreasing educational standards (Boughey 2010; 2007; 2005a; 2005b; Letseka & Maile 2008). Consequently, there have been proposals requesting the government to at least provide funds to deal with under-preparedness of matriculated students for Higher Education through additional academic development programmes in order to make up for the failures of the earlier education levels (Mdepa & Tshiwula 2012; Badat 2010; Boughey 2010, 2007; 2005a; 2005b). The Peer Teaching/Learning Experience Programme (PTLEP), an initiative of the School of Life Sciences in the University of KwaZulu-Natal is one of such internally instituted programmes to address the aforementioned challenges.

Among the 'post-1990 programmes', Universities have introduced academic support systems for students from sub-standard schools often assuming that the cause of poor academic performance in Black South African students lies within the individual inadequate academic preparation (Kioko 2010; Boughey 2010; 2007; 2005a, 2005b). This problem has often

been addressed by offering extra tutoring, remedial instruction, supplemental instruction, special preparation programmes, or introductory programmes especially for the 'at risk students' (see Kioko 2010; Boughey 2010; 2007; 2005a; 2005b; Drane *et al.* 2005; Fullilove & Treisman 1990). For example, Supplemental Instruction (SI) developed in 1973 at the University of Missouri-Kansas (USA) to respond to a change in student demographics and a sudden rise in student attrition (Arendale 2002). The SI initiative was adopted in South Africa on the national level in the year 1990 and at UKZN in the year 2008. The SI initiative aimed at providing academic support to undergraduate students with a hope of improving the pass rates (Bengesai 2011). However, the programme failed to attract students and Bengesai (2011) reported a low participation rate of 2% of students who attended most of the SI sessions and 16% of students who regularly attended the SI sessions. Similar challenges were also noted in the School of Life Sciences. Senior students (in their 3rd year to PhD level) were employed to facilitated time tabled 45 minutes SI tutorial sessions for first year biology students. However, the challenge was that students who needed this support did not attend as expected. Despite the claim that SI can create a learning space (Bengesai 2011; Paideya 2011) and although it was intended to help students improving their pass rate, it obviously was not attractive for the South African students in need of this support.

Learning from previous learning experiences, in 2010 a group of postgraduate students (including one of the authors) formed a study group as efficient means of studying initiated extra-tutorials for level one biology (Biology 101 and Biology 102) in the School of Biological and Conservation Sciences (now the School of Life Sciences) at the Pietermaritzburg campus of the UKZN. The main goal was to encourage and motivate students to learn from and teach each other. This was in line with Freire's idea that 'whoever teaches learns in the act of teaching and whoever learns teaches in the act of learning' (Freire 1993:72). The success of the initiative led to the formation of a complex multi-layered peer support system where students learned from/taught each other using the Peer Teaching/Learning Experience Programme (PTLEP) (Hakizimana & Jürgens 2012).

Unlike many peer-led academic support systems working with small groups (such as SI) that cater for a small number of students (10–20 students) in a group, the PTLEP worked with a very large number (100–300 students)

in one venue. Since this approach is contrary to what is commonly recommended in terms of optimal group sizes for learning (see Wilkinson & Fung 2002) we were interested to find out whether attendance as well as active participation in relation to the previous academic support programme (Supplemental Instruction = SI) had improved. In addition we were interested to learn how students perceived the programme in terms of pedagogical as well as socio-psychological adjustments. In 2011, questionnaires were given to students participating in the PTLEP in order to get a feedback that would be used to improve the initiative. This article will therefore give an overview on PTLEP and the use of workshops to provide academic support to disadvantaged Black South African undergraduate students at the School of Life Sciences, University of KwaZulu-Natal (UKZN), South Africa. We highlight key features that differentiate PTLEP from other peer to peer led initiatives such as Supplemental Instructions, give a short review on theoretical ideas supporting the PTLEP initiative, and share what we have perceived as the success of PTLEP in terms of attendance, active participation as well as student perceptions.

Overview of the Peer Teaching/ Learning Experience Programme at UKZN

The PTLEP is a complex, multi-layered peer support system where students learn from/ teach each other (Hakizimana 2011). The initiative originated from a reflection on the experiences of a group of students who had formed a study group as an efficient means of studying from Access Programme to Master's level at UKZN. This strategy involves interaction between peers of the same educational level (co-peers) as well as peers of different groupings (junior and senior students) of higher education levels (near-peers) (Frey 1990; Goldschmid & Goldschmid 1976). These peers become a source of information for each other. The model system was comprised of four to five layers and was built on peer-based learning (peer cooperation) (Hakizimana & Jürgens 2011).

There were two major relationships depicted by the system: a symmetrical and an asymmetric relationship. The symmetrical relationship was based on peer collaboration that led to cooperative learning (Roscoe & Chi 2007). The symmetrical relationships as supported by the education

theorist Piaget in 1928, resulted from the co-peer system where peers were of equal abilities shared, discussed, challenged their own partial and incomplete knowledge. Their disagreements and agreements provided social and cognitive conflicts that served as a catalyst for understanding together (Roscoe & Chi 2007; Frey 1990; Goldschmid & Goldschmid 1976). There was also an asymmetrical relationships resulting in peer tutoring as well as reciprocal peer tutoring (Roscoe & Chi 2007). The asymmetrical relationships, as supported by the educational theorist Vygotsky (1978) resulted in the near-peer (peer tutoring as well as co-peer), where the more capable and knowledgeable students instructed, guided and managed the efforts of their peers in mastering the task, pushing them to the edge of their intellectual potential (Roscoe & Chi 2007; Frey 1990; Goldschmid & Goldschmid 1976).

Peer tutoring was done across three levels. The first level, reciprocal peer tutoring, was the most encouraged and involved a student who was more capable and understood the concept and several weaker fellow students. The second level of peer tutoring involved the junior facilitators, who were close in both age and educational level of the tutee and were fully aware of the concerns and frustrations of first year students. They explained concepts to students and based on their experiences elaborated on the best ways for learning concepts (Hakizimana & Jürgens 2012; 2011; Hakizimana 2011). Peer tutoring also involved senior facilitators. These are post graduate students, whose educational level was closer to the ones of the academics. These senior students spent most of their times in the lab and offices with their supervisors, shared tea during the break with lecturers and were fully aware of frustrations that academics faced in teaching first year students. In their explanations, these senior facilitators (Hakizimana & Jürgens 2012, 2011, Hakizimana 2011) elaborated on how to tackle questions, elaborated on concepts and advised students on what were the expectations of the lecturer and how to meet those expectations. Occasionally, academics participated in the academic workshop sessions, making the 5^{th} layer of support (Hakizimana & Jürgens 2012; 2011; Hakizimana 2011).

Similarities and Differences between PTLEP and other SI-like Programmes

Supplemental Instruction (SI) was developed as an academic support model

at the University of Missouri-Kansas City (UMKC) in 1973 (Burmeister 1996) and is based on a wide range of learning theories (Topping & Ehly 2001). Outside of the US SI programmes were introduced under various names such as Peer Assisted Study Sessions (PASS), Peer Assisted Learning (PAL), and Problem-Based Learning (PBL) (Burmeister 1996; Topping & Ehly 2001; Neville 2009). The basic idea of SI is to provide regular review sessions in which students work collaboratively and with peer support of students ('SI leaders') that have been academically successful or did well in that course. Traditionally SI has been used for courses that are academically challenging or for first and second year courses where pass rates are lower than 60%. SI review session may include discussions, comparing notes, and group work to prepare for tests. SI operates within the classical educational framework of working in small groups that meet on a regular basis (e.g. once or twice per week) and that work for sessions that are normally 45 minutes to an hour. Although PTLEP has a similar conceptual framework than SI it differs in the way it operates and how it is structured. While SI and other peer to peer led initiatives normally run weekly PTLEP sessions were only offered before test and exam dates at week-ends or after hours but without limiting the duration of each session. Limiting the number of sessions increased apparently the student's perception of the value per sessions and gave it an 'event character'. As a result students decided to increase the duration of the PTLEP sessions to up to 3 hours. Another unique feature of PTLEP was that it operated with large student numbers (Table 1). This allowed for a multi-level facilitation process where students acted as facilitators most of the time in the presence of the junior and senior students and lectures whose main role was to moderate the process.

Implementation of PTLEP

The first PTLEP was facilitated by postgraduate students at the School of Life Sciences, UKZN. Since they had been employed for several years as tutors, mentors and demonstrators, they were aware of the challenges faced by first-year biology students. In 2010, when the initiative started, only senior facilitators were used. In 2011, students that had made remarkable contributions to the discussions during PTLEP sessions were recruited as junior facilitators. They organised academic workshops which were

voluntary and held mostly during weekends or after hours to ensure that students had no other commitments (Hakizimana *et al.* 2010). Each academic workshop session, students signed a register for each session attended and each student were required to come with questions. The main drivers of the sessions were the students who also provided their own questions and study material. The students had to answer the questions by discussing and explaining the concepts collaboratively. The facilitators asked students to set common goals and to share their learning resources. An important part of the sessions were discussions used to create a positive social interdependence and to promote cohesion and solidarity among students (see Ghaith 2002; Elffers, Oort & Karsten 2012).

The academic workshops of the PTLEP were held close to the tests and examination times because this time was considered to be the best for students to focus on their learning, and because students had started to read the study material to prepare for tests or examinations. Hence, students were familiar with their course contents and could be more active in discussions (Hakizimana *et al.* 2010). Students were also aware of the sections that they still found difficult and they paid particular attention to those concepts that they did not understand. Together with fellow students who understood those concepts they actively explored the concepts during three hour-long workshop sessions by discussing questions.

Contrary to other academic support programmes based on peer teaching, where the numbers of participants are limited, the success of the PTLEP depended on the availability of a large number of students. This was because the programme was built on the premise that students had common positive goals and achieving one's goal depended on the peer's achievement; hence each student was eager to see his or her fellow student doing well academically.

Another cornerstone for the PTLEP was the positive resource interdependence where each student was regarded as a resource needed by his/her peers. This was true, since students posed questions and at the same time other students provided answers to those questions. Hence, the larger the number was, the more learning resources were available (Hakizimana & Jürgens 2012; 2011). This made the PTLEP unique and the authors would describe it as *organised chaos* as it has been successful in accommodating as many as 300 students in a workshop session. Our approach of bringing

together a large number of students seems to have been counter-intuitive and we must admit that it was contrary to the previous teaching experiences of one of the authors (Andreas Jürgens) who had been a university lecturer for six years in Germany. It would be interesting to know whether such a programme would work in an European context since students in Europe might perceive working in such large groups as being unproductive. However, in our South African context a large group appears to be a motivating environment. This suggests that the socio-cultural background of learners has a strong effect on the success of an educational methodology as Vygotsky (1978) highlighted that human inquiry is embedded within culture (Glassman 2001). The *organised chaos* of the PTLEP made it possible for every student to receive individualised attention, as each student was a learner and at same time a peer tutor and these roles were sometimes interchangeable. When necessary, students worked as pairs but debated concepts at the same time with other groups. Similarly, students worked in small groups of six according to their seating arrangements. We were surprised how well students coped with the noise around them and how they were able to work constructively in larger numbers, in smaller groups, and even in pairs. As a result, students received individualised attention, and had opportunity to speak as well as listen to one another (Hakizimana & Jürgens 2012; 2011). This supports Goldschmid's (1976) idea of the potential of peer teaching to offer individualized instruction as well as supplementing traditional teaching approach such the use of lectures. Based on the fact that students can interchange roles and that both student teachers as well as student learners benefit from peer teaching cognitively and effectively, Goldschmid (1976:441) went further to imagine a campus where all students would be teachers and learners at different times hence facilitating social interactions and enhancing learning. Through organised chaos, PTLEP accommodates as many as 300 students in one venue and provides them with both social and cognitive benefits that enhance learning.

Theories Supporting the Idea of the Peer Teaching/ Learning Experience Programme

More than four decades ago, Mackenzie, Evans and Jones (1970) stated that a peer student is often the least recognised, the least used and yet the most

important of all the resources that may be available to any student (Goldschmid 1976; Goldschmid & Goldschmid 1976; Treisman 1985). This view was also held as early as the first century when the head of a leading school of oratory in Rome, after appreciating how much a younger child could learn from an older one in the same class, described a new learner as a best teacher, capable of making education more humane, practical, and profound (Wagner 1990:22). This idea was formulated into a teaching system 1 500 years later by a Moravian refugee, Amos Komensky, who advocated mass education and recognised the potential of peer teaching as a promising teaching technique that would make mass education a success (Roscoe & Chi 2007; Wagner 1990; Bowermaster 1978). In writing 'He who teaches others, teaches himself', Komensky explained that the process of teaching gives deeper insight into any subject taught (Roscoe & Chi 2007; Wagner 1990).

The use of student peers in the process of learning became more prominent through Dewey's (1963) pronouncements on the social nature of learning. He pointed out that 'the social nature of learning experienced in a community suggests that educative experiences includes opportunities to apply new learning and test one's ideas against the experiences of others, in addition to one's own experiences' (Dewey 1963, cited in Schmidt 2010:132). This is true, since reflection is very important in education, as it may determine how we generate knowledge about teaching, how we develop teaching skills, how we link theory and practice and how previous experiences inform belief systems (McDonough 2006). Furthermore, it is acknowledged in education that, despite the assumptions that all students are learning in classrooms, many students do not appear to be learning what the lecturers claim to be teaching (Schmidt 2010). According to Dewey 1963 cited in Schmidt (2010:133)

> … lecturers do not have abilities to control what students learn ... lecturers can increase the likelihood that their students will have educative experiences by knowing how to utilize the physical and social surroundings that exist, so as to extract from them all that they have to contribute to learning.

Based on this view, a system such as the PTLEP can help in not only rein-

forcing cognition but also in creating an enabling environment for successful learning.

Methodology

Data was collected from academic support programmes at the School of Life Sciences (Pietermaritzburg campus, UKZN). The sample population constituted multiple enrolments in level 1 biology over a four-year period from 2009 to 2012. Biology 101 (*Smaller Side of Life*) is offered in the first semester and covers topics related to scientific methods, biological molecules, cell biology and genetics. Biology 102 (*Life on Earth*) is offered in the second semester and covers topics related to the ecology and evolution of animals and plants. The number of students enrolling for these modules at UKZN has increased steadily over the years. In some years, the enrolment was higher than 500 students at Pietermaritzburg alone (see Table 1). Success or failure in level 1 biology modules has serious implications in terms of student progress, especially because these biology modules are a prerequisite for a number of modules from different schools such as Life Sciences, Environmental Sciences, Agriculture, Plant Science, Animal Sciences and Dietetics. These modules are also elective in some majors such as Agricultural Economics, Agri-business, Chemical Technology and Psychology.

As mentioned above, PTLEP was not initiated with a research question in mind or as a research project. Thus, to evaluate whether the initiative improved the attendance we compared the average number of students who attended academic support. The participation in the academic support programmes for level 1 biology students was compared for the years 2009 (SI), 2010 (PTLEP), 2011 (PTLEP) and 2012 (PTLEP) based on data obtained from the class register. In addition some sessions were recorded with a video camera to gain insights on the participation of students during the session. The videos were posted on the course facebook page so that students could later use them for revisions (Figure 1).

According to Seldin (1976) cited by Goldschmid (1978: 255) ‘opinions of those who eat the dinner should be considered if we want to know how it tastes’. Seldin (1976) supports the use of student questionnaires when evaluating a teaching and learning programme. Student questionnaires

have been one of the most widely used instruments in evaluating teaching programmes (Golschmid 1976; 1978). It has been shown that the ratings of students on what constitutes effective teaching are reliable indicators of how much students have learnt and that they also correlate with their achievements (Goldschmid 1976; 1978). Although standard questionnaires are widely used we designed our own questionnaires to obtain feedback on specific and unique features of the PTLEP programme (Goldschmid 1976; 1978). To receive a feedback on students' perceptions of the programme, questionnaires were designed (see Appendix 1, Table 1 and Figure 2). The students were asked whether the workshop sessions provided a good and comfortable learning atmosphere and if they could help with social and academic adjustment. Other questions asked whether the workshop sessions helped students to improve their interactions with fellow students, facilitators and lecturers. Students were also asked if the sessions were motivating, whether they had improved their study skills and whether material were relevant for passing the course. The questionnaires were given to the first 124 biology students in 2011 and completed anonymously thus ensuring confidentiality.

For assessing the degree to which the PTLEP had an impact on student performance and participating in PTLEP sessions, we examined four distinct periods in the history of the PTLEP based on pass rates. The first covered the year 2009, prior to the establishment of the programme. This period provided us with baseline data about the performance of pre-PTLEP. This was the period when only senior postgraduate students were recruited to run a 45-minute weekly time-tabled academic support session for first year biology students. In other words, this first period provides us with a historical control group against which to measure the subsequent performance of PTLEP students. The second period covers the year 2010, a period when the PTLEP was created and not financed. The facilitators worked on a voluntary basis (Hakizimana *et al.* 2010). The third period covered the year 2011, when the PTLEP was fully financed by the School of Biological and Conservation Sciences. In the first semester of this period, PTLEP workshop sessions were conducted concurrently with the normal 45 minutes weekly time-tabled sessions. The second semester of this period, the weekly time-tabled sessions were cancelled and replaced by a Facebook page. The full support of this initiative coincided with the short employment

of a PTLEP coordinator as the academic support coordinator, facilitating the inclusion of the PTLEP as part of the academic support programme for the school (Hakizimana & Jürgens 2012, 2011; Hakizimana 2011). The fourth period was in 2012 during the university reorganisation. Despite the desire of the College to retain the PTLEP initiative, the programme was closed down by the school with the idea to replace it with an SI programme. However, due to logistical constraints, SI was not implemented in 2012 and after four academic workshop sessions (33% of the 12 sessions planned for the first half of 2012) were conducted, the PTLEP was discontinued (Hakizimana & Jürgens 2012).

Statistical Analysis

The average number of students per session for the years 2009 to 2012 in the Biology 101 and Biology 102 modules is presented in Table 1. A Generalised Linear Model (GLM) was used to test whether there is any significant difference in mean number of students per session (Table 1). To test whether there was any significant difference in mean number of students attending academic sessions across the academic years, Bonferroni pairwise comparisons were used. The pass rates of biology students before, during and after the establishment of the PTLEP are also presented in Table 1.

Results

Attendance of the Academic Support Programme

In 2009, before the initiation of the PTLEP, an average of 8.6 out of 406 students attended an academic support session for Biology 101 (Table 1). After the initiation of the PTLEP, the number of students attending academic support sessions increased to more than 100 out of 525 (19%) students per session in 2010 and to more than 160 out of 551 (29%) students per session in 2011 when the PTLEP was at its peak (Table 1; Figures 1a & 1b). For Biology 101, the number of students attending the academic support programme in 2009 to 2012 was significantly different across the years ($X^2 = 1958.837$, df = 2, $P < 0.01$). A significantly higher number of students attended Biology 101 academic support sessions in 2011 (160.1 ± 4.2

students) followed by 2010 (107.9 ± 3.7) and 2012 (the year in which the PTLEP was not fully implemented for BIOL 101). The lowest number of students attended the academic support in 2009 (8.6 ± 0.5 students). Each year was significantly different ($P < 0.05$) except for 2010 and 2012. Similar trends were observed for Biology 102, with the highest number observed in 2011 (169.1 ± 3.9), followed by 2010 (93.8 ± 4.3), and the lowest number observed in the year 2009 (6.8 ± 0.6). In 2012 the PTLEP was not conducted for BIOL 102 (Table 1). Many students, irrespective of race, gender, place of residence and intended studies, attended and actively participated in the academic workshop sessions of the PTLEP in 2011 (Figures 1a & 1b)

Participation in Academic Workshops of the Peer Teaching/ Learning Experience Programme

In 2011, students attending the PTLEP responded to the questionnaires. In total 124 students participated in answering the questionnaire. Of these, 96% were Black, 3% White, and 1% Indian. There were 62% females and 32% males and the rest (6%) did not disclose their gender. While 56% of students who responded resided outside university campuses, the remaining 44% resided in university campuses. The majority (49%) of the students intended to study in the School of Agriculture, Earth and Environmental Sciences, 45% in the School of Life Sciences and 6% in the School of Chemistry and Physics. There was high attendance and 80% of students attended between 7 and 9 of the 12 planned workshop sessions in 2011, representing more than 75% of the total number of sessions.

Students' Perceptions of the Peer Teaching/ Learning Experience Programme

Student responses highlighted many benefits of the programme. The academic workshop sessions motivated students to learn, and the discussions were relevant and enabled collaborative learning as students were able to interact with their peers. Also, the sessions improved students' study skills, and provided a good learning atmosphere that enabled academic and social adjustment (Figure 2).

Academic Performance, Persistence and Retention

After 2009, the pass rate in Biology 101 increased from 61% to 65% in 2010. The highest pass rate (85%) was observed in 2011. In 2012, the pass rate decreased to 72%. Almost similar trends were observed for Biology 102: an increase in the pass rate from 65% in 2009 to 76% in both 2010 and 2011, and then a decrease in the pass rate from 76% to 40% in 2012 (Table 1).

Discussion

Contrary to many peer-led academic support systems working with small groups such as SI that caters for a small number of students in a group, the PTLEP worked with a very large number, and first-year biology students highlighted that this voluntary peer-support-based programme created a motivating learning environment. This motivating learning environment can be described as a force that energised, directed and sustained behaviour toward achieving academic goals and may have led to the tendencies observed among students who found the academic activities of the PTLEP meaningful, beneficial and worthwhile (see also Hancock 2004). This may well explain the increase in attendance, since the creation of the PTLEP (2010) and the active participation in the academic workshop sessions (Table 1; Figure 1). In addition, students benefitted from sharing relevant study materials and felt that they discussed questions in an entertaining and comfortable learning atmosphere that was conducive to social interaction, not only among themselves, but also among facilitators and lecturers, thus enabling both academic and social adjustment.

The PTLEP created an environment where all students were learners and teachers, hence facilitating social interaction that enhanced learning. This is concurs with modern learning theory (e.g. Schmuck 1977) which stresses the role of active student involvement and feedback as well as the importance of playing alternative roles in peer cooperative learning since both the tutor and the tutee benefit from peer teaching, both cognitively and affectively. This two-way peer tutoring, where students of the same age and similar ability levels learn to be a tutor and to alternate tutor and tutee roles, has been described as reciprocal peer tutoring (Allen & Boraks 1978) and the process has been found to be superior to traditional peer tutoring. Using the

role playing theory, Allen & Boraks (1978) suggested that, taking on the role as a tutor is beneficial to students' academic growth, as it motivates students to understand a concept or skill personally before explaining it to peers. As a result, playing a tutor's role enhances cognitive development and the students' self-esteem may be boosted when they identify with the role of tutor. As this role is played interchangeably in the PTLEP, students playing the role of the tutor may have had different abilities and different ways of explaining certain concepts to each other better, making the programme most efficient (see Frey 1990; Allen & Boraks 1978).

A similar approach was used in a mathematics workshop for Black American students in the United States (Fullilove & Treisman 1990; Treisman 1985). After identifying the negative factors hindering academic and social adjustment to university life among Black American due to an observed pattern of cultural, social and academic isolation, Treisman (1985) assimilated the study habits observed in Chinese American students who formed informal study groups as a vehicle to help them to master mathematics and acquainting themselves with university life. The study group was composed of students with a shared purpose where members not only shared mathematical knowledge but also shared understanding of what is required by their professors and university. To help Black American students, Treisman (1985) initiated a study group network where students supported each other and were able to overcome the challenges of learning calculus. The study group also provided Black students with opportunities to combine their social and academic lives, hence abandoning their social isolation pattern. The programme improved the academic performance and retention of Black American students (Fullilove & Treisman 1990; Drane *et al.* 2005).

The positive feedback from students regarding the PTLEP can be explained further in line with the participation-identification model which explains how students identify themselves with the school and how students participate in the school's activities (Elffers, Oort & Karsten 2012). Furthermore, the results are also in line with the social support theory, where according to Tinto (1975; 1997) bonding between classmates seems to be a strong indicator of academic success. According to Ghaith (2002) and Ghaith, Shaaban & Harkous (2007) the availability of facilitators and peers is critical for academic achievement and psychosocial adjustment. Similarly, as

highlighted in the responses of our students, PTLEP as a form of cooperative learning enabled biology students to set common goals, to share resources, and to create a positive social interdependence that promoted cohesion and solidarity among students (Costen, Waller & Wozencroft 2013).

We want to point out that our main focus was to create a social learning space since both authors had the strong feeling, based on their own experiences in other countries, that this was an important component not offered to our students at UKZN. Therefore, an equally important measure for the success of the programme was, for us, the attendance as well as positive responses from the sample group. Prior to the implementation of the PTLEP, student participation in academic support programmes was low but it increased significantly with the implementation of the PTLEP approach (Table 1). The positive responses of students with regard to the overall contribution of the PTLEP to the learning process also seem to indicate that creating a social learning space considering the specific socio-cultural background of the students might be a key to releasing the hidden potential of students (Figure 2).

Conclusion

Retaining and graduating disadvantaged Black students, especially those in the fields of science and engineering, has been a challenge. The literature indicates that while Black students' enrolment in higher education in the science field has undoubtedly increased, poor performance, high attrition and low graduation rates result in the loss of some of the most gifted students from the sciences and the loss of future leaders of the scientific community. The high failure rate is a threat to the future of South Africa especially because the country faces special skills shortages.

The results of our study have shown that in contrast to previous academic support initiatives, there has been a steady increase in attendance and active participation in academic support programmes since the implementation of the PTLEP in the School of Life Sciences, UKZN. Students who participated in the research indicated that they had found the learning environment as motivating and felt that it facilitated the improvement of their study skills. Relevant materials for passing the course were discussed in a comfortable learning atmosphere and this was conducive

to social interaction between first-year biology students themselves, the facilitators, and the lecturers, thus enabling both academic and social adjustment.

By mobilising senior students to facilitate workshops, the PTLEP achieved strong cooperation among undergraduate and postgraduate students, academic staff, and support staff. The programme changed students' perceptions of their own role during the learning process where their own, active contribution to learning was an integral part of the learning process in first-year modules. The PTLEP incorporated peer collaboration and both same-age and cross-age peer tutoring, and these multi-layered peer interactions were particularly important in mitigating the effects of the high student-lecturer ratios. Student evaluations also show that the PTLEP offered pedagogical benefits, as it decreased competition among students and increased cooperation, motivation, self-confidence and self-esteem.

Similar to other universities, UKZN introduced academic support programmes to improve the pass rate of students. However, the literature has shown that, in most cases, these westernised initiatives have failed to attract Black students in need of such support. According to theorists on peer-led academic support, working in large groups is perceived as being unproductive. However, this study has shown that in our South African context, large groups are perceived as a motivating environment. This suggests that students' socio-cultural backgrounds have a strong influence on the success of any educational methodology. This is a unique contribution, especially since universities in South Africa are still undergoing transformation and home-grown initiatives like the PTLEP would go a long way in reducing failure rates among Black students.

Damon (1984) described peer education as the untapped potential. The positive responses of the sample group with regard to the overall contribution of the PTLEP to the learning process suggest that creating a social learning space that considers the specific socio-cultural background of Black students might be a key to releasing their hidden potential, thus helping to reduce the failure rate and the skills shortage in South Africa.

We think it is premature at this stage to speculate on the effect of PTLEP with respect to pass rates or student performance. Based on a synthesis of the data collected and responses of the participating students we recommend that a more detailed conceptual study should be conducted to

establish whether PTLEP has a measurable effect. Such a study should focus on a comparison between the different operational frameworks of SI and PTLEP because both programmes are similar with regard to their learning philosophy but not how they operate in terms of group size, learner numbers, timing and duration of sessions.

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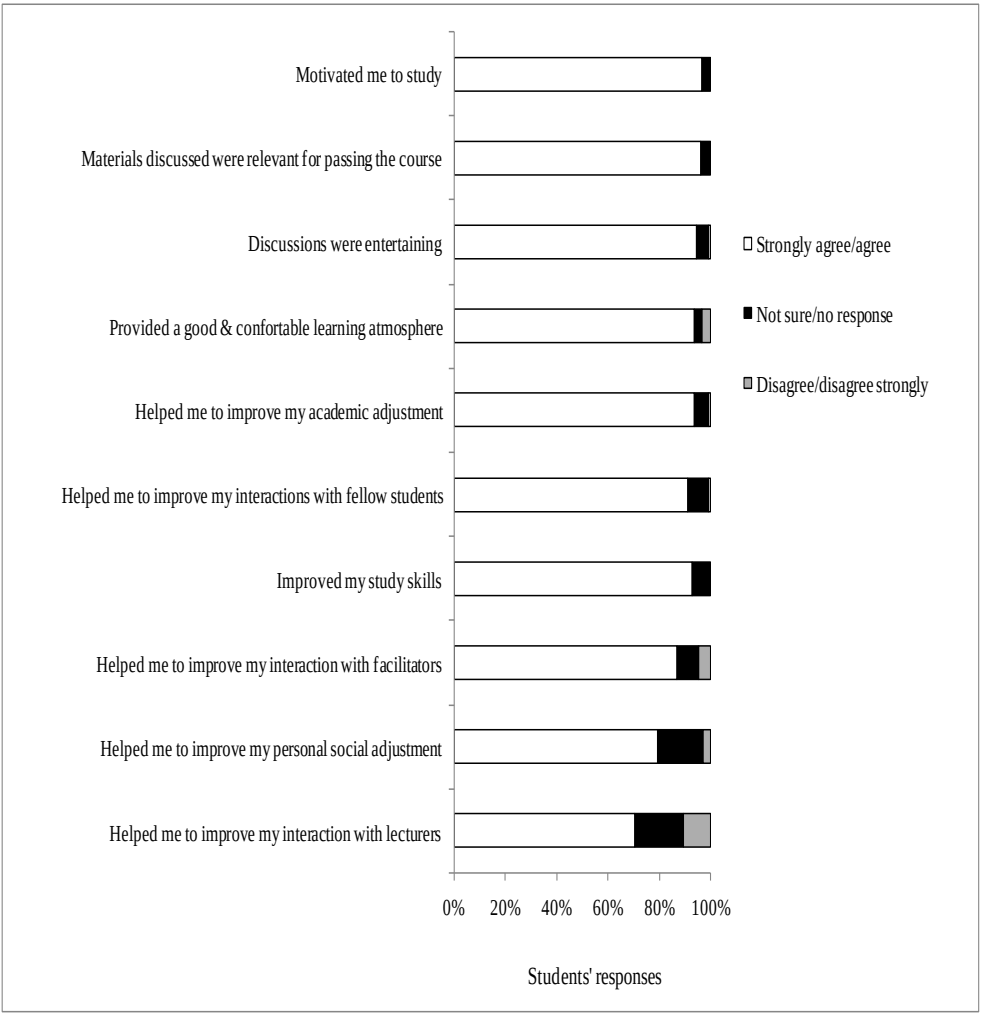
Table 1: Number of registered students for two first-year biology modules at UKZN [BIOL 101 (Smaller Side of Life) and BIOL 102 (Life on Earth)], average number of students per workshop session, and pass-rate for PTLEP and non-PTLEP periods.

	Registered students		**Number of students per session**		**Pass rate [%]**	
Year	BIOL 101	BIOL 102	BIOL 101	BIOL 102	BIOL 101	BIOL 102
2009	406	249	6.8 ± 0.5^{a}	6.8 ± 0.6^{a}	61	65
2010	525	364	107.9 ± 3.7^{b}	93.8 ± 4.3^{b}	65	76
2011	551	363	160.1 ± 4.2^{c}	169.1 ± 3.9^{c}	85	76
2012*	427	309	124.5 ± 5.6^{b}	–	72	40

Different letters indicate a significant difference between years.
* In 2012 the PTLEP was not fully implemented for BIOL 101 and not conducted for BIOL 2012.

Figure 1: Biology students actively participating in Academic workshop of the PTLEP in 2011**.** A = ca. 300 students on a weekend session, B = Students writing questions on the board

Figure 2: Students' perceptions of the Peer Teaching/Learning Experience Programme (PTLEP) at UKZN, School of Life Sciences.



Appendix 1. Questionnaires

Please answer the following questions by marking a field:

I agree				I don't agree
		x		

Peer Teaching/ Learning Experience Programme (PTLEP)

1. Improved my study skills

I agree				I don't agree

2. Motivated me to study

I agree				I don't agree

3. Helped me to improve my academic adjustment

I agree				I don't agree

4. Helped me to improve my personal social adjustment

I agree				I don't agree

5. Helped me to improve my interaction with lecturers

I agree				I don't agree

6. Helped me to improve my interactions with facilitators

I agree				I don't agree

7. Helped me to improve my interactions with fellow students

I agree				I don't agree

8. Provided a good & comfortable learning atmosphere

I agree				I don't agree

9. The materials discussed in the programme were relevant for passing the course

I agree				I don't agree

10. The discussions were entertaining

I agree				I don't agree

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