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SELF ASSESSMENT AND STUDENT- CENTRED LEARNING

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Abstract

This paper seeks to show how self assessment facilitates student-centred learning (SCL) and fills a gap in the literature. Two groups of students were selected from a single class in a tertiary educational institution. The control group of 25 was selected randomly by the tossing of an unbiased coin (heads = control group). They were trained in the traditional manner (TCL) using mostly chalk and talk with numerous textbook examples for practice. The experimental group of 25 representing the remaining students in the selected class was trained using a SCL focus with emphasis on self assessment. Both groups were exposed to the Mathematical topic of *Piecewise Graphing*. Their scores on ten compulsory identical textbook questions on the topic of *Piecewise Graphing* were compared. Comparison of the scores of students exposed to both approaches of learning showed that generally students of the experimental group outperformed their counterparts at all achievement levels (top, middle and bottom). Students of the experimental group were able to pin point their specific areas for improvement whilst those of the control group took no interest in determining ways for improvement. Because SCL places the learner at the centre of the learning process, giving him autonomy and responsibility for his own learning this research has added value to industry personnel. The emphasis on being customer focused in industry may have translated itself to being student focused in education. It is hoped that readers would use the ideas offered to improve their practice.

Keywords: self assessment, student-centred, teaching, learning, graphs, mathematics.

Introduction

As early as 1905, Hayward posited the concept of student-centred learning (SCL). Other educators like Dewey, Rogers, Piaget, Knowles and Froebel have made their contributions to the conversation (O'Neill & McMahon, 2005). More recently, as customers are demanding their rights and there is emphasis on being customer focused, educators have chosen not to be left behind. This partly explains the renewed attention being placed on student-centred learning (SCL). SCL places the learner at the centre of the learning process giving him/her autonomy and responsibility for his/her own learning. The teacher acts as facilitator, resource person and fellow learner. The learner makes strategic choices regarding what, how, why, where and when to study. Such choices promote deep learning with understanding as opposed to surface or rote learning. The learner uses a number of techniques like reflection, meditation, discussion, counseling, journaling and research to facilitate learning. Despite the focus on individuality, the learner is in concert with a global community by using agreed standards for evaluation. Hence the learner has a sense of place in a wider community that promotes self-reliance, sustainability, responsibility, energy efficient designing and planning and mutual caring.

SCL tends to replicate real life experiences in real time using natural patterns. It is this experiential learning that is so powerful in reinforcing concepts and cementing ideas in the minds of students. Through its integrated, multi-purpose activities, SCL acknowledges the intrinsic worth of each individual which is a basic life ethic. Each individual is appreciated as a holistic being who has an invaluable contribution to make. The learner brings to the table all his past experiences, knowledge, understanding and perceptions to contribute to any issue

under consideration. Each individual is a steward who contributes to the synergistic and symbiotic relationships required for integration, innovativeness, entrepreneurship, industry and efficiency. SCL concepts are applicable to all student abilities and preferences so that no one is omitted in the scheme of things.

The focus is therefore on the learner rather than on the teacher. The learner identifies learning issues and is self motivated to explore them at his own developmental pace. This results in personal growth. The learner actively participates in the learning process with a sense of independence, yet interdependence with the teacher or facilitator. There is mutual respect in the relationship with all parties benefiting. Not only is there emphasis on cognition (cognitive domain) but there is proportional emphasis on affection (affective domain) and activity (psychomotor domain) in the overall development of both learner and teacher or facilitator. In this environment emphasis on a kind of assessment that is student centred seems reasonable.

The learner has to be able to have some measure of responsibility and autonomy on his assessment and operate in a collaborative manner with the teacher or facilitator. Mutual respect for each other's assessment is mandatory. Tokenism is not allowed and each party must feel that his contribution is acceptable and would be taken seriously in the official assessment recognised by the accredited institution. This present paper therefore seeks to illustrate how self assessment defined as 'the involvement of students in identifying standards and/or criteria to apply to their work and making judgments about the extent to which they have met these criteria and standards' (Boud, 1986: 5) allows for learner participation in assessment *for* learning in a student-centred environment.

Literature Review

O'Neill and McMahon (2005) see real-life learning as positioned between two ends of a continuum where teacher-centred learning and student-centred learning lie at the extreme ends. At the teacher-centred learning end of the continuum there is low level of student choice. Passivity and power lie primarily with the teacher. By contrast, at the student-centred learning end of the continuum there is a high level of student choice. Activity and power lie primarily with the student. In practice, there is movement within the contextual barriers in the teaching situation. This present paper concerns itself with the implications for self assessment practice in SCL.

Undoubtedly, the involvement of students in assessment that counts and their role in course design should enhance learning. There are numerous challenges associated with assessment in general. In the literature Black (1999) discussed issues like over emphasis on marks to the detriment of the learning process; comparison of students with each other fostering unnecessary competition over personal improvement; and students taking responsibility for their own learning. The basic assessment challenges faced by educators appear to be universal in nature.

Because of the tremendous amount of autonomy and personal responsibility inherent in self assessment inadequate active involvement, monitoring and use of feedback on the part of the teacher could adversely compromise the process and undermine the benefits to be obtained from self assessment. Self assessment demands sincerity; integrity; honesty; recording skills; time keeping skills; ability to follow instructions; paying attention to details; and independent thought. Within a model of self-regulated learning, Butler and Winne (1998) locate the giving of feedback, where the learner assumes responsibility for his/her

improvement. 'Monitoring is the hub of self-regulated task engagement and the internal feedback it generates is critical in shaping the evolving pattern of a learner's engagement with a task' (p. 275) they affirm. Bearing in mind that monitoring is not the same as feedback, monitoring facilitates the self-regulated engagement and generates feedback that is mandatory for self-improvement. Timely feedback provided by the teacher makes the learner aware of his or her status on the task undertaken and allows him/her to take positive action. Additionally, it allows deliberate use of the information collected to chart corrective action, in order to bring the learner on course as specified at the beginning of the activities. Such feedback may come from a variety of sources other than the teacher. These include authority figures, peers, friends, significant others, the self, and resource materials.

SCL has at its heart the learner's self- perception. Van Krayenoord and Paris (1997) observed that students of high ability tend to underestimate their own performances while students of lesser ability tend to overestimate their performances. However, when students focus their self assessments on clear criteria and/or standards this tendency was diminished. "*Good*" students tended to underestimate their performance while "*poor*" students tended to overestimate it according to Orsmond, Merry and Reiling (1997). They found that students producing good work were more self-critical than they were judgemental, whilst students producing poor work were less critical but more judgemental. Adams and King (1995) found that students handing in good assignments addressed both strengths and weaknesses of their work while others seemed to focus only on the strengths. In SCL a considerable amount of time is necessary to train students. There has to be sufficient teacher-time to conference with students. SCL allows for the development of life long skills to realistically assess one's own performance, plan future goals, and enhance academic achievement.

McDonald (2010) showed that students formally trained in self assessment outperformed their untrained counterparts. For the purpose of this present paper the researcher focused on the human aesthetic that Stange (2006) claims ‘*is strongly rooted in pattern and repetition*’.

She affirms that:

‘ we seek symmetry in form in most arts, as well as in science. The mathematician seeks an 'elegant' proof above one which demonstrates the same result through contradiction or examination of numerous cases. He prefers one with a 'symmetry'; many proofs require the logic to follow in both directions at once. He seeks the simple, the fundamental from which to build his great mathematical structures. The artist or poet seeks a similar symmetry in many ways; the metre of poetry is a subtle counting, and the words chosen are a concise reflection of the experience of the poet. He seeks to give his poem a contained, elegant form, with verses and stanzas showing the inner symmetry of thought’. <<http://katherinestange.com/mathweb/>>

This researcher found that by adding an appropriate poem to her illustrations unresponsive students who tended to be bogged down by a series of formulae and algorithms were stimulated to get involved in deep understanding. For them, it illustrates that Mathematics is an integral part of everyday life and is to be appreciated like any other discipline. Further, it reinforces the interdisciplinary nature of the world around us and helps students to relate positively to their own culture. Hence the research design that follows.

Research Design

For the purpose of this present paper the researcher focused on two groups of students from a single class in a tertiary educational institution. That specific class was selected by virtue of the number of contact hours they had with this researcher compared to other groups. The control group of 25 was selected randomly by the tossing of an unbiased coin (heads = control group). They were trained in the traditional teacher-centred learning (TCL) manner using mostly chalk and talk with numerous textbook examples for practice. The experimental

group of 25, representing the remaining students in the selected class, was trained using a SCL focus with emphasis on self assessment. Both groups were exposed to the Mathematical topic of *Piecewise Graphing*. Whilst the control group was shown textbook examples on a chalkboard and concentrated on working on practice examples from the prescribed textbook, the experimental group used a variety of mutually agreed innovative methods summarised in Table 1. To safe guard the integrity of the experiment, the control group was not privy to information given to the experimental group. The latter was advised and monitored to ensure that confidentiality was maintained. Negative reactions that had the potential to possibly lower test performance were minimised by careful monitoring. Under similar standardised conditions, both groups were given ten compulsory identical textbook questions on the topic of Piecewise Graphing. Each question was weighted similarly (10 marks each). A panel of experts knowledgeable of the content area meticulously selected the questions. Several instruments used in the process are available upon request from this researcher. The scores of both groups were compared (Tables 3, 4, 5). Individual differences and the nature of the students' participation were subsumed under the experienced professional practice of this researcher in order to minimise the number of variables in the experiment. The research design was replicated across several groups so that the actual sample size is really a multiple of 50. Nevertheless, for reasons beyond the scope of this present work, only one experimental group would be reported on in this present paper.

Methodology

After several class discussions learners of the experimental group agreed on a list of ten varied activities that would enhance their deep understanding of the topic, Piecewise Graphing in Mathematics (Table 1). As mentioned earlier, this information was unavailable to the control group who proceeded in the conventional manner to which they were accustomed. This researcher decided on this course of action primarily because the learners resented Mathematics and found extreme difficulty in internalising basic Mathematical concepts. At the tertiary level the learners were pursuing a variety of careers for example Accountancy, Business Management, Education and Nursing. After considerable time and effort, a group of reputable content experts arrived at consensus using the Delphi Technique. This researcher attended to all ambiguities and ensured clarity of detailed prerequisites for mark assignments. Validity of the instrument (Table 1) was verified through the conventional methods: face, content and construct validity.

<Table 1 to be inserted here>.

To provide a practical demonstration, the researcher formulated poem below was used to promote student understanding of *Piecewise Graphing*. Students particularly those proficient in comprehension skills and those who loved languages found that the poem assisted them in understanding the fundamental mathematical concepts.

Researcher designed ‘*Piecewise Graphing*’ in Mathematical Poems

A graph in pieces!
Never thought about it until college
Think of several pieces
And you have a piece wise graph!

One function may obey certain rules
Another function may have other rules
And yet another function has more rules
And we could go on and on and on.

Each function is defined for a given domain
And end points may be included or excluded
If included, shade the end point circles
If excluded, shade not the end point circles.

So to graph a piecewise function
Graph each piece separately over its given domain
Shade or not shade end point circles that remain
And that’s all there is at this junction.

Source: <http://bettymcdonald.cgpublisher.com/product/pub.30/prod.1880>.

Data Analysis and Results

Comparison of the scores of students from the top, middle and bottom levels of academic achievement from both groups exposed to different approaches to learning showed that generally students of the experimental group outperformed their counterparts at all levels. Students of the experimental group were able to pin point their specific areas for personal improvement whilst those of the control group took no interest in determining ways for improvement. Students from the experimental group reported being excited about their sense of **empowerment**:

Student A: ‘...I felt like I were the only person in the class...so individualized was the attention I received...’

Student B: ‘...I am confident about myself much more than I ever was before...I know what I am about, I believe in myself and I know I will succeed...’

Student C: ‘...It’s good to feel like part of a group but when the group is no longer there I used to feel alienated but now with student centred learning as an individual I can adjust to a variety of situations without too much difficulty...’

Student D: ‘...my self-esteem has grown by leaps and bounds...At my workplace my colleagues have noticed the difference and they continue to compliment me...I truly feel good about myself...’

Regarding **understanding**, following are some selected comments:

Student A: ‘...My understanding has improved by leaps and bounds...my peers can testify to this ... I appreciate the reasons for situations and not simply accept the situation without inquiring ...’

Student B: ‘...Self assessment allowed me to fully understand not only what I was doing but also how I was being assessed for what I had done...That kind of empowerment is satisfying ...’

Student C: ‘...There is nothing better than knowing for yourself that you truly understand concepts...It gives you an inner feeling of being in control instead of trying to blame others for not doing well ...’

Student D: ‘...Before this experience I simply used to learn off stuff by heart without understanding ...For me it was passing an examination ...I could not care about understanding... Now I do appreciate what we are doing...’

Concerning **achievement** here are some selected comments:

Student A: ‘...My marks are a testimony of my achievement ...It was never like this before I was exposed to student centred learning...The library helped me a lot...’

Student B: ‘...There is nothing better than enjoying what one is learning...Being a success tends to come naturally because you no longer feel like climbing up a climbing wave...’

Student C: ‘...At first I was skeptical but now I would recommend student centred learning to anyone...It is the best! ...It gives you the results you love ...Best of all I get a refund of my fees paid to this institution. What more do I need?...’

Student D: ‘...*Self assessment is much more powerful than I thought...To think one is judging himself against agreed upon standards makes one feel confident that the result is acceptable and can stand the test of scrutiny by any reputable person...*’

Discussion

Teachers higher up on the teacher-centred, student-centred continuum are less likely to use expressions with derogatory connotations that could tend to belittle students. Students in a student centred environment are treated like individuals. Teachers use self assessment strategies that according to McAlpine (2000) encourage ‘*metacognitive abilities and critical evaluation of the learner's educational goals and promotes student autonomy and decision making*’. McDonald (2010) found that students trained in self assessment skills tended to be divergent thinkers, creative individuals, assertive communicators and cooperative individuals; essential attributes of an all-rounded individual. This is no small wonder when one considers that self assessment acknowledges choices and preferences in student learning styles and is particularly relevant for open-ended learning activities. It is easy to induct novices into an environment where their contributions are respected and cherished. Students are caused to feel empowered, self confident and capable of achieving attainment targets. The teacher is able to vary learning styles to accommodate learners that show definite preferences for alternative learning styles normally unappreciated by others. Very often numerous kinds of normal in-house competitions that would tend to bring out the worst in some individuals tend not to be given prominence in SCL.

Like any other method, SCL has its critics who contend that too much focus on the individual may not be too healthy for personal growth and development. For them, a one-size-fits-all mentality is preferred. However, when one considers that in today's world where consumers demand customization, it seems only fair to translate the same principles into education of

the populace. Demographically, students appear to be changing with time as they demand a type of education that focuses on the self.

Individual differences like autonomy, responsibility for one's own learning and creativity were not considered in this present paper because the immediate focus of this study was student achievement. Most students were full time employed and for the most part were primarily interested in credentialing for upward mobility in their respective work places.

Another study done by psychologists attached to the same tertiary institution revealed that by and large the majority of students preferred a tactile/kinesthetic learning style. They learn best through a hands-on approach as they actively explore the physical world around them. Sitting still for long periods was challenging for them while reciting mathematical poetry became interesting. Using the Internet and other forms of exploratory activities provided opportunities for students to learn easily. Thus in this present study the assumption was that learning style was a relative constant.

It may be argued that the generalisability of the findings to organisational samples could be questionable because students are less likely to expect active participation than employees in training and development programs. Further, it may also be argued that the content of 'Piecewise Graphing' may not elicit the same response as designing the contents of a day-long training program. Nevertheless, the fundamental principle entails active participation which is what really matters in the long run to the student. The extent of the participation is less significant than the participation itself. The fact that individuals can feel an integral part of the process provides them with the kind of empowerment that leads to improved self-esteem and motivation to learn.

Conclusion and Recommendations

The emphasis on being customer focused in industry may have translated itself to being student focused in education. In the literature on performance appraisal one constant finding is that when employees are involved in the design of assessment scales there is more user acceptability. In particular, O'Brien (1995) in investigating employee involvement in performance improvement for total quality management, acknowledged three pivotal concepts: 'the distinctive focus on process improvement for generating new forms of interaction at work; the importance of employee tacit knowledge for contributing to process improvement; and a new form of trust based on mutual interest between employees and management as a crucial intermediary variable contributing to commitment' (p.110). Additionally in the training and job analysis literature, comprising expert employees as panelists, similar findings have been reported. What makes this research significant is the fact that it contributes to existing literature at the classroom level where presumably individuals are nurtured and trained to play their roles in the adult world. The research shows that certain fundamental qualities do not appear overnight but must have their genesis in focused training and sustained development. More importantly is the fact that even with a small sample of 50 students in the task of learning about graphs (a single topic in a single subject of the existing curriculum), significant differences were observed testifying the usefulness of the intervention of student centred learning. The role of the library cannot go unnoticed in promoting student centred learning. Internet usage; learning management systems; social networking; journal articles and other library facilities enable students to learn at their own pace and satisfy their own interests.

Despite the fact that both self assessment and student-centred learning are continuously being discussed in the literature not much information connecting both has been unearthed. This present paper seeks to fill that gap in the literature and allow practitioners to appreciate how they could transform their classrooms to interactive, accommodating, mutually benefiting environments where students feel free to express their thoughts, learn to interact with each other and yet thrive as independent thinkers.

Several researchers have lauded the value of SCL especially from a social constructivist perspective where physical activity, projects, practicums, field trips, discussion groups, conversation circles, briefs, laboratory sessions, colloquia, informal gatherings, plenary and parallel sessions, archival searches, internet searches, interviews, questionnaires, poster preparations, group presentations, interactive workshops, conferences, portfolios and journaling with a community of learners are emphasised. Student choice in learning is emphasised and facilitated with modularisation. Unnecessary time normally spent on work already covered is minimised as students are allowed the benefit of addressing their own identified learning issues. Learners have the opportunity to work in groups or individually to accomplish their identified tasks. The relationship between learner and teacher is one of mutual respect and understanding.

By the same token critics have cited the pitfalls of too much individuality for the social learners in SCL that may lead to disempowerment (Edwards, 2001). This researcher is of the view that if the choices are sensitively handled by both teacher and learner the experience could be holistic and invigorating. Presenting lesson objectives or learning outcomes from the point of view of what the learner should be able to know/do at the end of the lesson assists in reinforcing learner empowerment. Personal experience with Problem-Based

Learning indicates that both learner and teacher may negotiate together to obtain reasonable learning outcomes that provide the learner with autonomy and responsibility consistent with personal growth and development that could be easily transferred to industry and future endeavours.

Other critics have bemoaned the need for additional resources for SCL. However, McDonald (2010) was able to demonstrate that students could be trained with a student centred learning bias by equipping them with self assessment skills that require no additional resources. This is important especially in certain developing countries where scarce resources normally tend to cause educators to shy away from innovative practices. Democracy and choice become important concepts that were practised by learners in keeping with their individuality.

Accordingly, individual differences of the learners are celebrated. This has enormous implications for their personal self-esteem and the manner in which they relate to others throughout their lives.

In their work on higher education, Prosser and Trigwell (2002) showed how different belief systems held by staff and students could influence outcomes in SCL. For example, they found that the more teacher-centred focus to teaching on the part of the teacher, the greater their expectation for students to accommodate information rather than develop and change their conceptions and understandings. They also found that the reverse applied to those teachers with a more student-centred focus to teaching. As teachers move along the continuum from teacher-centred teaching to student-centred teaching their level of tolerance for discussion and interaction increases.

The results obtained indicate that students exposed to a student-centred mode of learning were better able to assess themselves with a reasonable degree of accuracy using the

teacher's assessment as a guide. Such students were able to focus precisely on the areas where they needed improvement and so were able to influence positively their future learning. By contrast, students exposed to a teacher-centred learning style seemed to self assess according to their individual conceptions and were not able to specify their areas for improvement. No reflection appeared to have occurred and students appeared not to hold themselves accountable. Students exposed to SCL honed excellent communication skills in addition to numerous other vital life skills for effective daily living as they pursued their personal interests. Generalist approaches leave too much latitude for reoccurrences of errors and misconceptions entertained to the detriment of low performing students.

With increasing international concern about quality and standards, this paper presents SCL as an effective method for improving the quality of public education in the Commonwealth.

More importantly, SCL is tied to self assessment, accreditation and evaluation. It proffers that we concentrate our efforts on the student. SCL separates the rhetoric from the reality of quality assurance as it delves into the very heart of the individual to feel heard, accepted, recognised and cherished. SCL has no barriers in terms of levels of societal development. In poor countries, where people may naturally feel disempowered, SCL has the bonus of contributing towards minimising, monitoring, inspecting and favouring accreditation systems that are most appropriate for large systems in poor countries. Even where learners are taught and assessed in a language which is not their native tongue, SCL actually compensates for possible inadequacies in educational systems by bridging the gap between learner and teacher or facilitator, making the learning process more manageable and enjoyable.

This researcher recommends the use of student-centred approaches like project-based learning and service learning in tandem with self assessment to ensure that students are given

the best possible opportunity to maximise their potential as they develop high order thinking skills. Issues raised are grounded in students' every day experiences so they could easily identify with their selected learning issues. Subject compartmentalisation is minimised as deep learning is emphasised as opposed to surface learning for its own sake. Students are able to explore their multiple intelligences in relation to their specific learning styles and personality traits.

Operating in a world closer to reality where 'answers' are not viewed in a dualistic manner (as right or wrong), but in a relativistic manner (as valid options), enables learners to adjust more easily to the world of work. Learners foster lasting interpersonal relationships as they interact with each other in a meaningful manner. Besides, innovative methods, like the composition of poems to illustrate mathematical concepts, using existing resources (however limited) in educational institutions would preclude the need for additional funding to make it happen. In summary, even low performing students stand to benefit tremendously from approaches that tend to move to the right of the continuum with TCL and SCL at the extremes.

Bibliography

- Adams, C. & King, K. (1995). Towards a framework for student self-assessment, *Innovations in Education and Training International*, 32(4), 336-343.
- Black, P. (1999), Assessment, learning theories and testing systems, in Murphy, P. (Ed.), *Learners, Learning and Assessment*. London, Open University Press, 118-34.
- Boud, D. (1986), *Implementing Student Self Assessment*, Sydney, HERDSA.
- Edwards, R. (2001). Meeting individual learner needs: power, subject, subjection. In C. Paechter, M. Preedy, D. Scott and J. Soler (Eds.), *Knowledge, Power and Learning*. London, SAGE.
- McAlpine, D. (2000). Assessment and the Gifted, *Tall Poppies*, 25(1). Retrieved from http://www.tki.org.nz/r/gifted/pedagogy/tallpoppies_e.php.
- McDonald, B. (2010). *Self Assessment and Academic Achievement*. ISBN-NR: 978-3-8383-3360-1: Lambert Academic Pub AG & Co. KG, Saarbrucken, Germany.
- McDonald, B. (2008). Mathematical Poems. *The International Journal of Learning*, 15(9), 145-158. Retrieved from <http://bettymcdonald.cgpublisher.com/product/pub.30/prod.1880>.
- McDonald, B. (2006). Inclusive Assessment. *Enabling Education, Enabling Education Network (EENET)*, University of Manchester, UK. Retrieved from http://www.eenet.org.uk/key_issues/assess_exam/inclusive%20assessment.doc
- O'Brien, R. C. (1995). Employee involvement in performance improvement: a consideration of tacit knowledge, commitment and trust, *Employee Relations*, 17(3), 110-120.
- O'Neill, G. Moore, S. & McMullin, B. (Eds.) (2005). *Emerging Issues in the Practice of University Learning and Teaching*, Dublin: AISHE.
- O'Neill, G. & McMahan, T. (2005). Student-Centred Learning: What does it mean for Students and Lecturers?, 27-36. Retrieved from <http://www.aishe.org/readings/2005-1/oneill-mcmahan>.
- Orsmond, P., Merry, S. & Reiling, K. (1997). The use of student derived marking criteria in peer and self assessment, *Assessment and Evaluation in Higher Education*, 25(1), 23-38.
- Stange, K. (2006). Mathematical Poetry: A small Anthology. Retrieved from <http://katherinestange.com/mathweb/>.
- Van Krayenoord, C.E. & Paris, S.G. (1997). Australian students' self-appraisal of their work samples and academic progress, *Elementary School Journal*, 97(5), 523-537.

Table 1 SCL Activities for the Topic Piecewise Graphing in Mathematics

#	Description of activity	Score
1	Identification of a real-life situation in which Piecewise Graphing was applicable	15
2	Planning a field trip to illustrate Piecewise Graphing	15
3	Writing learning journal entries on the plans for the field trip	10
4	Buzz group (in twos) discussion of field trip	5
5	Writing a poem on Piecewise Graphing	10
6	Designing a poster on Piecewise Graphing	15
7	Solving for a textbook question on Piecewise Graphing	10
8	Designing a mark scheme for the textbook question in 7 above on Piecewise Graphing	10
9	Writing reflective notes on the topic of Piecewise Graphing	5
10	Maintaining a suitable portfolio	5
	TOTAL SCORE	100

Note. Detailed breakdown of scores for each activity are available from the author upon request.