USE OF STATISTICAL METHODS IN THE QUALITY ASSURANCE OF CONTINUOUS ASSESSMENTS

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ABSTRACT
Tutor Marked Assignment (TMA) plays an important role in providing useful feedback to learners. It is a form of continuous assessment used frequently in open distance learning (ODL). Not only is it a crucial learning support to learners in assessing their individual progress of learning, but also useful for tutors to monitor the progress of learners in reaching the learning outcomes. However, the study of this continuous assessment mainly managed by the tutors is an area which has received relatively little attention until recently. The communication between tutors is critical in avoiding issues of isolation and disconnectedness, particularly in courses related to computer programming. This paper discusses a monitoring mechanism to determine the consistency among tutors' marking of a particular set of TMAs involving a Java programming course. Further, the monitoring mechanism also helps to assess the efficiency of the feedback of the TMA to the learners. The monitoring mechanism provides information to the tutors that can be used to help improve their feedback to the individual learner with more encouraging statements and specific comments to improve. The use of the monitoring mechanism has shown improvement in terms of the consistency of learners' feedback and marking.

KEY WORDS
Quality Control and Assessment, Open University and Best Practices and Case Studies

1. Introduction

Assessment provides a framework for feedback and communicating with learners their progress of learning. Traditionally, assessment of learning has been categorized as either formative or summative [1]. The summative assessment provides evidence for public reporting and to determine the status of learning [2]. Meanwhile, the formative assessment or sometimes called the continuous assessment aims to enhance and improve learner learning [3-5]. Both of the assessment methods have been used widely in most of the open universities in the world. However, compared with conventional universities at various stages of delivering of a subject, the mode of Continuous assessment in open universities is somehow different. The main reason is due to its delivery methods which provide limited face-to-face teaching, blended with flexible learning approaches through open distance learning, [ODL]. In some cases direct teacher-learner interaction is also often not considered an economically feasible option with higher education [6]. The ODL mode of education delivery has created a special challenge for the Continuous assessment in individualised manner to large and heterogeneous groups of learners.

Therefore, the learning effectiveness in open universities places considerable reliance on part time tutors. They are guided through prescription driven advisories which are usually based on the feedbacks of the learning process. We do not have enough study on how such a mechanism buttresses concerns of quality especially in continuous assessment. This is a subject that requires research which can assist in improving the teaching and learning environment because it generates information that can be useful to learners to enhance their learning achievements.

This paper focuses on continuous assessment that usually takes place during the course of the semester in an open university. The continuous assessment focused here is often referred to as tutor-marked assignment (TMA). The

TMA is specifically marked by a Tutor, a person who plays a vital role in the learning process. A conceptual model of the continuous assessment monitoring cycle of the university is presented by using a case study of a computer programming course. This paper has assessed the consistency and the quality of the feedback from the monitoring mechanism from two presented assignments. Several principles of good feedback practice are highlighted with some examples of good strategies.

## 2. Role of Tutors in Continuous Assessment: The WOU's perspective

Wawasan Open University (WOU) is a new university which was established in the year 2006. Course delivery methods used in the university follows common open universities' framework where learners have periodic face-to-face meetings and online interaction with their course specific tutors at local learning venues. Tutors help to mediate between learners and the courses/university via a range of interactions such as offering guidance, assessment, support, and motivation [7].

Continuous assessment is an integral part of teaching and learning in WOU. WOU's tutors are trained to facilitate tutorial, to mark assignments and give feedback to individual learners in a specific form which is provided to them. The feedback information aims not only to help tutors to realign their teaching in response to learners' needs but to also aid in learning by generating feedback information that is of beneficial to learners. Feedback on performance on assignments enables learners to improve their understanding or skills and build more powerful ideas and capabilities. Continuous assessments also provide information to tutors and to the university about where learners are experiencing difficulties, where to improve their teaching efforts and where else the university can support them.

However, tutoring as a professional activity has been carried out largely unseen and unanalyzed, or 'undervalued' [8]. Moreover, tutors are employed on a part-time basis in WOU. They are offered temporary contracts relying on the learner intake which may have long-term effects on their professional status and standing. They also have very limited input into course design. They play the role of implementer of the continuous assessment. Similar to the arguments made in [9, 10], tutors' enthusiasm, responsibilities and commitment in implementing the structure of learning will influence the learning effectiveness in WOU. With our institutional conceptual understanding versus the actual practices, WOU has designed a monitoring mechanism to ensure the quality and consistency of the tutors' marking on the assignment and also the feedbacks given to individual learner.

3. WOU Learning Model

Continuous assessment in WOU is conducted and marked by Tutors. As mentioned earlier, they are called Tutor-marked assignment (TMA) and these are a major component in the conduct of the course. Figure 1 presents WOU structure in a course preparation and presentation. The design and development of the course material starts with the setting of the learning objectives and learning outcomes with the relevant syllabus. It is then followed by the development of the course material with value-added input from instructional designers and content experts in a team lead by a course team chair who is called the course coordinator (CC). Besides these internal fulltime members, an external party involved includes an external course assessor who is appointed among the scholarly experts in the field. The structure in course preparation and presentation of WOU is shown in Figure 1.
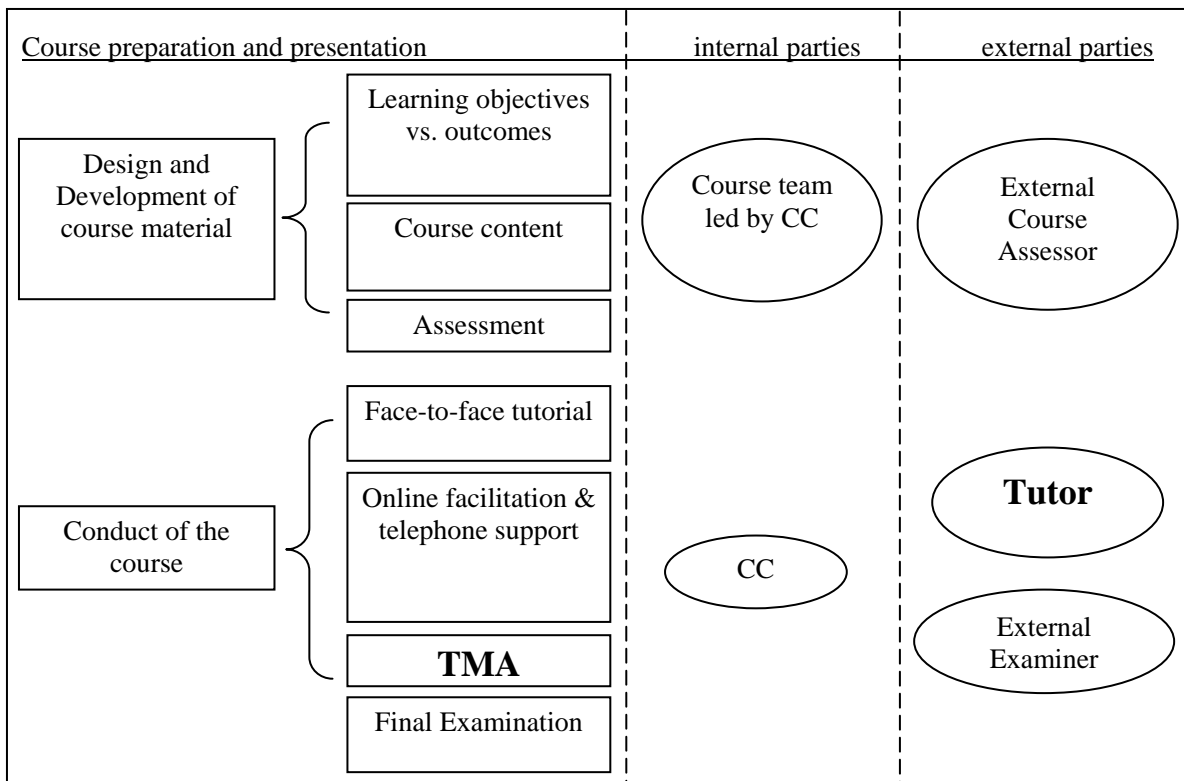
Figure. 1. WOU structure in course preparation and presentation

In the presentation of a course, tutors deal directly with the learners. Usually, each tutor will be in charge of a maximum of thirty learners in a tutorial group. According to the learner number, a number of tutors for a subject are allocated in a regional centre. Tutor's involvement in the conduct of the course includes the face-to-face tutorial, online facilitation in the Learner Management System (LMS), telephone support and TMA marking. The CC will monitor the tutor in the conduct of the course through several mechanisms such as visits to respective regional centres to observe the tutorial conducted by different tutors and monitoring of the LMS activities. Another important task of a CC is to carry the moderation of the tutors marking and their feedback for the TMA. Besides all of the above, an external input through a named external examiner is also incorporated into the mechanism to ensure quality control in the overall conduct of the course.

The tutor monitoring model in WOU is built on the relationship of the tutor with the university. As shown in Figure 2, the learner has a first line of communication with the tutors while the subsequent lines of communication include the CC and the Dean of the school. A more regular interaction is expected between tutors and learners, mainly related to course content and the TMA components which serve as the benchmark in assessing the progress of learning.
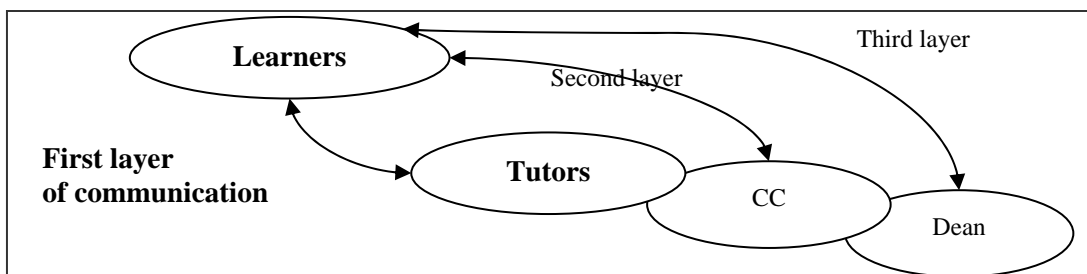
Figure. 2. Relationship between University and tutors

4. A Case Study

In this paper, a case study was conducted for a technology course named Fundamental programming using Java. One hundred and seventy five learners registered for the course and three TMAs were conducted in the semester to continuously assess the learners' progress. Eight tutors were selected for the tasks from four different regional centres. In this study, we select two TMAs in order to show how the monitoring takes place. The two TMAs are related to the basic knowledge of computing and Java as well as on the understanding of the object-oriented concept.

A background of learners in terms of age range distribution and area of learners' job specification is presented in Table 1 and 2. The majority of the learners selected are from the younger group from 20 to 29 years old. However, we also have twelve percent of learners who aged more than 40 years old. Akin to common open universities, our learners are working adults. The selected course in the case study is a compulsory technology subject for computing and electronics related bachelor programmes. About sixty percent that is the majority of our learners are working as technician and factory operators. Out of this majority percentage, nine percent of the learners are working in the computing/Information Technology (IT) area and sixty one percent works as technician and operator in factories. Another interesting observation is about seven percent of our learners are already holding a managerial or director level positions.

Table 1. Distribution of age range

Age range	Learners count
20-29	58%
30-39	30%
40-54	9%
> 55	3%

Table 2. Distribution of area of learners' job specifications

Area of jobs specification	percentage
IT related	9%
managerial, executive, director level	7%
technician/operator	51%
Clerical related	5%
Teacher	2%
sales/marketing/accounting/auditing/tax related	10%
others	8%
unknown	7%

4.1 TMA Structure and Design

In the first TMA presented to learners, which requires them to express their understanding on the basic concept of programming languages and their differences with the Java programming language, learners need to explain the difference between a high-level programming language and machine language. They also are tested on the basic concept of compilation of Java source code file with the relevant command and the process involve behind.

In the second TMA presented, learners are tested on the basic object-oriented concept. They are asked to identify possible objects and derive classes from a case given. They are also asked to identify possible attributes and operations of classes and to draw object interaction diagrams for the objects identified. Lastly, they are required to draw class diagrams for the classes with data and operation.

4.2 WOU Monitoring Mechanism

There are several components in WOU monitoring mechanism. First, for the face-to-face tutorial, there is at least one visit conducted for one tutor in order to track the tutor's teaching in the tutorial class. The person who observes the tutorial is usually the CC. The observation aims to monitor on how a tutor conducts a class, the dynamic of the tutorial group, the tutor's ability to explain key concepts as well the person's rapport with the learner and participation of the learners. This information is collected mainly to ensure the tutor has fluency in communication, his/her ability in handling learners' questions as well as other competencies as group organization and interactivity. The competency in facilitating the tutorial is an important trait of a tutor. Other factors observed include the tutor's patience, motivational skills, resourcefulness and IT savviness. Tutors found to be lacking in one or another skill are kept under a more careful watch, for additional training. The main objective for the visits is to know the tutor well, so that the university can provide the necessary coaching to ensure a high standard of delivery. As the tutors are the first interface to the learners, the university always ensures the team of tutors possesses desirable characteristics to manage learners learning environment.

In the continuous assessment, TMAs' marking scheme and suggested answer are provided to tutors. There is an ongoing communication between CC and tutors updates on learner status. The CC will also observe the learning process through the LMS. In addition, the CC will conduct a detail analysis on the marking and feedback given to the learners by each tutors. First, a sample of the submitted TMA scripts from the each tutor will be selected. A minimum of three copies from lowest, average and highest marks of the scripts marked will be collected for CC monitoring. The following aspects of the tutor's work are monitored:
- Quality and nature of commentaries made on the marked script
- Justifying / explaining the grades awarded.
- Highlighting specific "good" and / or "poor" work by the learner.
- Referring to specific passages / sections / materials in the course.
- The tone of the commentary is supportive such as helpful, sympathetic.
- Using TMA well, e.g., drawing attention of learner to specific items in the scripts; giving holistic appraisal, guidance and sample good answers

The tutor will be alerted if they are
- making unsubstantiated judgment, comments and unrealistic demands
- not reporting the missing scripts or parts of script.
- not making enough use of the opportunity in grading to advise learners to improve
- submitting the marked TMAs late to the regional office.
- fail to "total up" the scores.
- not showing learners why the line of thought/ argument is faulty.
- giving too much or too little credit for a partially correct answer.
- not noticing glaring errors.
- not commenting on poor presentation of assignment.

In the case study conducted, the first TMA was the case before the monitoring mechanism and the second TMA was the case after the monitoring mechanism. The following section will discuss the analysis from the comparison of the TMA result before and after this monitoring mechanism.

5. Analysis of the Result

The case study of the selected course result is analysed using the StatGraphic software. Three different analyses are conducted here mainly to survey the effectiveness of WOU observation and monitoring mechanism in the continuous assessment from the result obtained by the learners. The analysis gives a more objective view in measurement of the consistency of tutors in eight different regional offices which are usually located apart. The eight different regional offices were 3CP11 and 3CP12 from Kuala Lumpur, 4CP11, 4CP12 and 4CP13 from Penang, 5CP11 and 5CP12 from Ipoh, and 7CP11 from Johor.

5.1 Variance Analysis

First, a variance analysis based on Levene's tests is conducted for significant differences between the variances level. This test performs an analysis of variance on the absolute deviations of the observations from their sample means.

The statistic displayed in Table 3 shows the result of the comparison using the variance analysis. Of particular interest is the P-value. Since the P-value is less than 0.05, there is a statistically significant difference amongst the standard deviations at the 95.0% confidence level. This violates one of the important assumptions underlying the analysis of variance and will invalidate most of the standard statistical tests.

On the other hand, for TMA 2, the P-value is greater than or equal to 0.05, there is not a statistically significant difference amongst the standard deviations at the 95.0% confidence level. **This has shown that the monitoring mechanism imposed by WOU after TMA 1 has improved the consistency of the result.**

**Table 3. Variance Check for TMA 1 and 2**

Levene's	TMA 1		TMA 2	
	Test	P-Value	Test	P-Value
	4.302	0.0002302	1.155	0.333

5.2 Analysis of Means (ANOM)

A somewhat different approach to the comparison of level means is presented in the Analysis of Means or ANOM Plot. This plot constructs a chart similar to a standard control chart, where each level mean is plotted together with a centerline and upper and lower decision limits. ANOM is a graphical procedure for comparing a collection of means, rates, or proportions to see if any of them differ significantly from the overall mean, rate, or proportion. The results of the analysis are summarized in an ANOM decision chart in Figure 3 and 4. It has a centerline (CL), located at the overall mean (rate, or proportion), and upper and lower decision limits (UDL and LDL). Group means (or rates, or proportions) are plotted on this chart and if one falls beyond a decision limit then that group is said to be statistically different from the overall mean (rate or proportion).
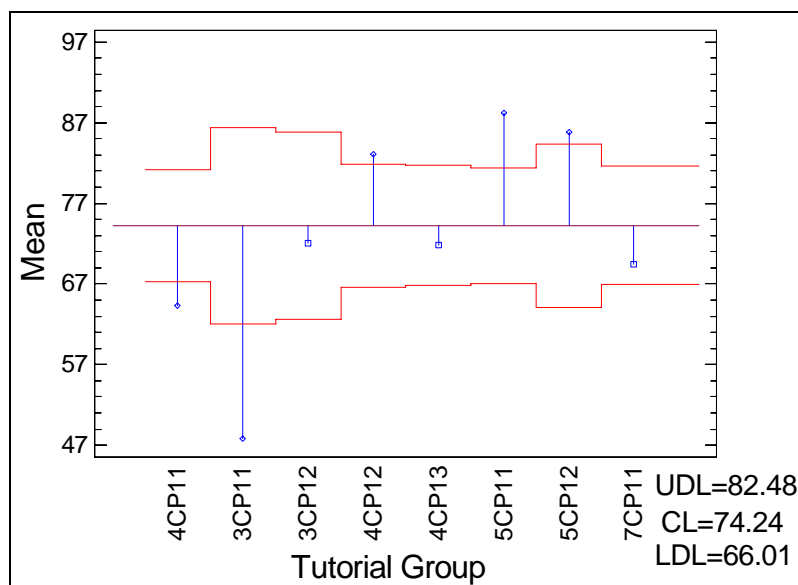
Figure 3. Result for TMA 1
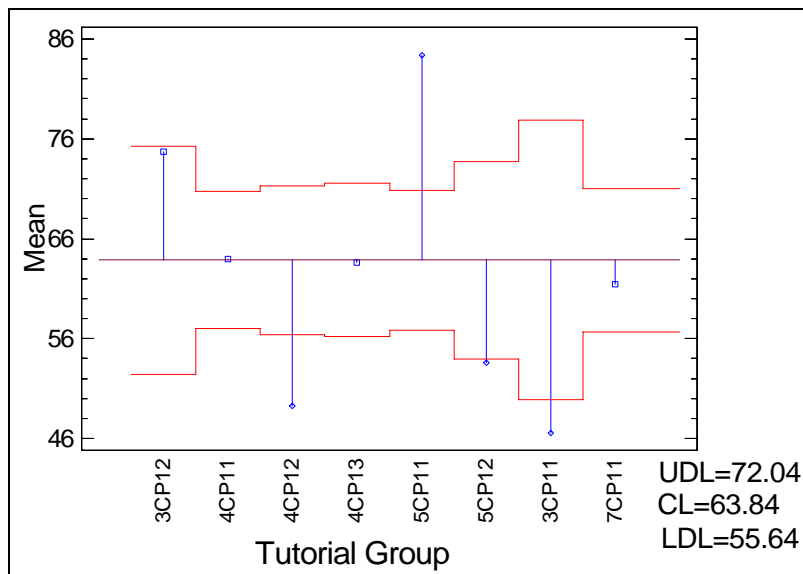
Figure 4. Result for TMA 2

The ANOM charts are plotted with 90% decision limits in this paper. The centerline is located at the grand average of all of the observations. As shown in Figure 3, TMA 1 has five higher or lower mean than average for tutorial group 3CP11, 5CP11, 5CP12, 4CP11 and 4CP12, while TMA2 has only three higher or lower mean than average for tutorial group 3CP11, 5CP11 and 4CP12 as indicated in Figure 4. The great improvement has occurred in the tutorial group for 4CP11 which has lower mean in TMA1 than TMA2. For tutorial group 5CP11, there is an increase in higher mean mainly due to the generousness of the tutor in charge in the award of the marks.

5.3. Box and Whisker Plot

Box-and-whisker plots are helpful in interpreting the distribution of data. In basic features of the data in the case selected, a box-and-whisker diagram is a convenient way of graphically depicting the following five items:
- Minimum observation,
- Q1: 25% of the data set is below the first quartile
- Q2: 50% of the data set is below the second quartile, which usually refers to the Median
- Q3: 75% of the data set is below the third quartile
- Maximum observation.

Unlike many other methods of data display, a box-and-whisker plot reveals the absence of symmetry.

In the plots presented in Figure 5 and 6, it has shown an improvement for the tutorial groups 3CP11 and 4CP13 in particular, because it has a smaller Interquartile Range (IQR) for its range of values between the first and third quartiles. The symmetry of 5CP11 has been improved because the absence of symmetry in TMA 1 has been improved with a more symmetry result.
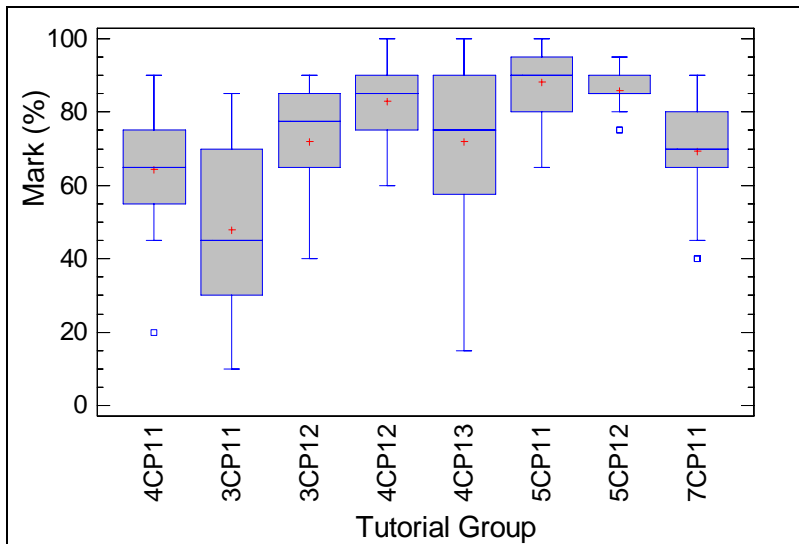
Figure 5. Result for TMA 1
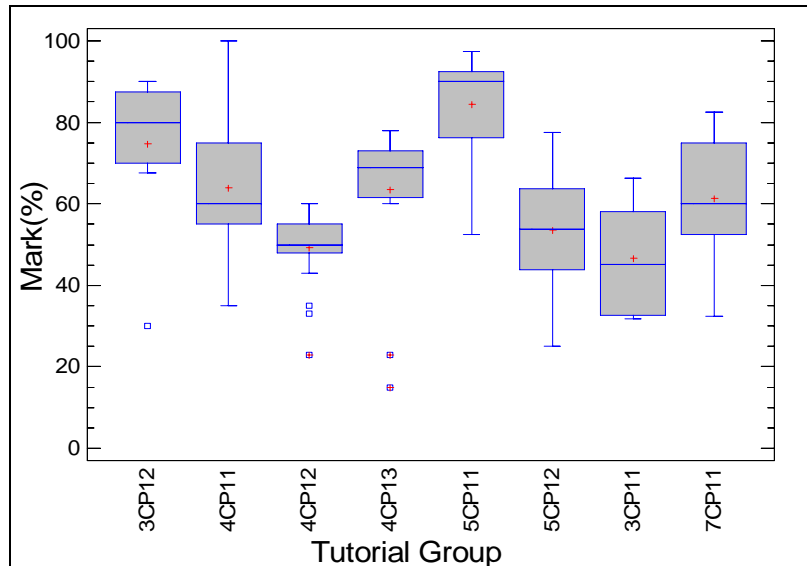
Figure 6. Result for TMA 2

6. Conclusion

This paper has presented the role of tutors in continuous assessment. In the WOU learning model, tutors plays an important role to facilitate the learning process not only in the limited face-to-face interaction but also through feedback information given based on continuous assessment in prescribed form provided by the university.

A quantitative analysis has been conducted to survey the effectiveness of the monitoring mechanism in the consistency of the marking of an assignment. A case study of a programming course has been used in the survey and two assignments results have been used as cases before and after the monitoring mechanism. The analysis of the result has shown that the use of the monitoring mechanism has improved the consistency of the marking from the analysis of variances in section 5.1.

A minimum level of useful comment by tutors is recorded by the university and they serve as a factor to reselect tutor for following terms or semesters. A checklist of the recommend feedback is suggested to tutors and it serve as standard for a tutors to follow. The assessment of the tutors' feedback is relatively difficult to control at the

moment because tutors were not involved in the design of the assessment objectives. The open problem area related to this work presents the challenges of how to refine the principles for feedback practice, identify gaps between the university and tutors and to gather further evidence about the potential of continuous assessment and feedback to support the learning process.

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