Reflections on on-line teaching and learning, based on learning process data

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ABSTRACT: In the Internet era, it is possible and necessary for tutors engaged in on-line teaching to reflect on the learning process, so as to continuously improve the on-line teaching. Based on a Moodle on-line course, as a sample, an analysis of on-line teaching reflection, from the perspective of tutors, was conducted. A new form of teaching reflection was also explored. The results of the research have indicated that learning analytics is effective in supporting tutors' reflections on interactive on-line teaching and learning. First, analysis of tutors' and learners' behaviour during learning can help tutors grasp the full picture of a learner's development on an on-line course. Second, an analysis of interactive forums can help tutors focus on key teaching and learning activities, and achieve a more accurate analysis than with face-to-face teaching.

INTRODUCTION

Since 2011, MOOCs (massive open on-line courses) have been developed rapidly by top universities in the United States and have had worldwide impact. It sets a good example of on-line learning, and the model shows that for on-line learning to be effective, all aspects of a university course must be realised on-line including classroom teaching, students' experience, interaction between teachers and students, availability of tutors and instructional activities [1]. This shows that on-line learning is not autonomous learning, but rather gives full play to the guiding role of the tutors.

In on-line learning, interactions between teachers and students usually are separated in time and space. Synchronous teaching exists, but it is asynchronous teaching that can offer more help to meet the needs of personalised learning. Unlike face-to-face teaching, on-line tutors find it difficult to grasp the situation of a learner's development on an on-line course. However, it is possible to know about the teaching process through the records of the learning process on the on-line learning platform. Based on these, it is possible to reflect on and continuously improve the on-line teaching.

LITERATURE REVIEW

Teaching reflection has, as the reflective object, the teaching process, and the basis of reflection is a faithful record of the teaching process. Posner, an American psychologist, considered the growth and development of teachers and the reflection on their own experience. He put forward a teacher growth formula, i.e. reflection + experience = growth [2]. Thus, reflection is important for teachers' growth and professional development.

There are various methods of teaching reflection. Wang and Zhao point out that the main methods of teaching reflection include video reflection, diary reflection, reflection from the perspective of the learners, reflection based on communication with colleagues and experts, and reflection based on consulting students [3].

Zhang illustrated the techniques of teacher development, including observation teaching; microteaching, teaching decision-making and teaching reflection [4]. Yu et al classified the reflection of teacher training into video reflection, dialogue reflection and teaching reflection [5].

The basis of teaching reflection is a faithful record of the teaching process. In the *journal reflection method*, the first step is to carry out a detailed and faithful description of the teaching events, which includes problems in the teaching. In the *reflection from the view of learners*, the first step is to briefly record the time, situation, learning content and trainers (the teachers or the hosts). In the era of information networks, teachers can make use of modern education technology to obtain a faithful record of the teaching process to facilitate an effective teaching reflection, which can better promote their own professional development [6].

New network technology provides teachers with new teaching reflection tools. In this study, recent technology was considered as a powerful tool for teachers to carry out on-line teaching reflection. In the study, massive amounts of data about students were analysed to evaluate their academic progress, predict their future performance and to identify potential problems [7]. For teachers, this can be used as an analysis of the teaching, so that they can provide students with more targeted teaching [8].

In on-line learning, the on-line learning platform provides a detailed record of the behaviour between teachers and students, i.e. a *de facto* classroom teaching record. Analysing the behaviour between teachers and students with study analysis technology one can capture a record of the process of on-line learning. This can allow teachers to understand fully the teaching activities and each student's progress, clarifying otherwise vague impressions and assisting teachers to identify the merits and shortcomings of the teaching, resources and evaluation.

For this research on-line courses were selected using the Moodle platform. Study analysis technology included discourse analysis and social network analysis. Data mining methods employed included visualisation, clustering, prediction, relational mining, text mining and Chinese word segmentation [9].

Tools included SSAS (SQL Server Analysis Services), SPSS, UCINET, Excel and ICTCLAS (a lexical analyser). The research was conducted from the perspective of a teacher carrying out on-line teaching reflection based on the record of the learning process, and was aimed at exploring new forms of teaching reflection.

RESEARCH SAMPLE

The network education practitioners' training courses were used for the research, and were hosted by the National Open University as the research object. The training class depends on the Moodle platform (http://etutor.crtvu.cn). There are three classes, viz. students support services, on-line learning guidance and on-line course design. Each class lasts six weeks, during which students perform on-line learning through the Moodle platform and tutors provide full-course on-line tutoring. The fifth training class of the on-line tutoring course was chosen as the research sample.

DATA ANALYSIS AND TRAINING REFLECTIONS

For analysis of the teaching process, the platform module access, module access sequence and time distribution of teacher and student activities were considered. Teacher and student activities, which originally were space-time separated, were reintegrated to restore the sequence of tutor and student interaction.

Table 1 shows the statistical results for teacher and student access to the Moodle platform during the training period.

Table 1: Teachers' and students' access to the top five modules.

Module	Frequency of access	Percentage of accesses (%)	Major operation
Forum	7,097	52.2	Browsing the posts and postings
Course	2,601	19.2	Logins to the platform
Wiki	1,513	11.2	Browsing and editing
Resource	1,215	8.9	Resource browsing
Assignment	1,158	8.5	Checking homework and submitting work

Module Access Analysis

The statistical results in Table 1 show that *forum* is the most common access used by teachers and students, accounting for over 50 per cent of the total activity. This shows that classroom discussion is the most important learning activity.

After *course* are *wiki*, *resource* and *assignment*, which individually are relatively small. The wiki module facilitates students searching for information in a collaborative environment. *Resource* refers to browsing resources, which is an important part of discussion and collaborative learning. The final study outcome is the assignment. The frequency of access to these modules is reasonable and reflects the teaching process.

Access Characteristics of Modules by Time

In order to understand the change of focus among teachers and students during different time periods, the time dimension of the access characteristics of modules was considered in the research. The access frequency of platform modules in different weeks during the training shows how the activity of teachers and students varies with time in the main learning modules. The results are shown in Figure 1.

As can be seen from Figure 1, discounting the high frequency access module forum, the user and resource modules are emphasised in the two weeks before the start of formal learning and the first week thereafter. This reflects that, at this time, students are becoming familiar with people and course content. It informs that, before the start of the course, tutors could get involved two to three weeks in advance of the course to engender a smooth introduction to it and to encourage student initiative.

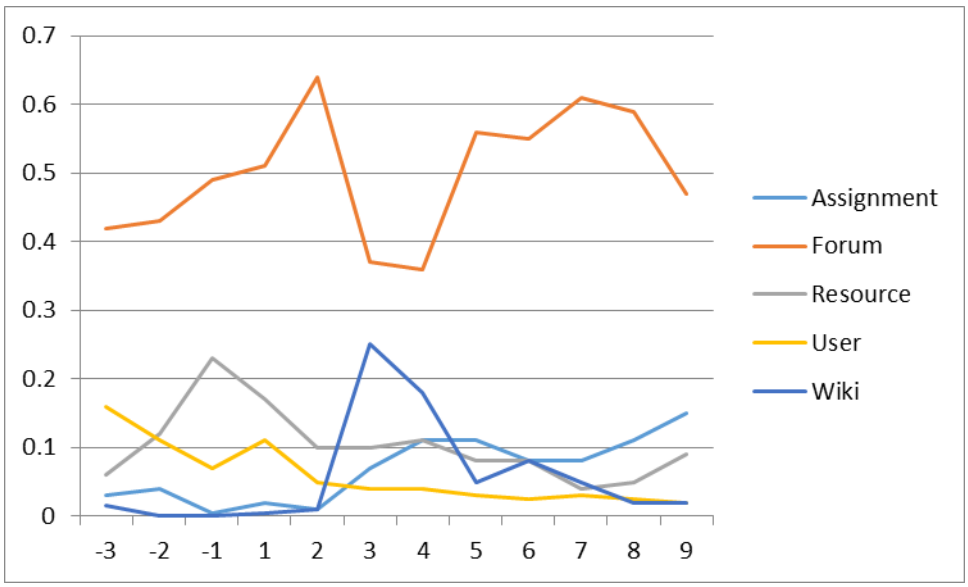

Figure 1: Activity of teachers and students by time for the main modules.

After the start of learning activities in the second week, the main modules accessed are wiki and forum. Wiki activity peaks in the third week. The first wiki co-operative group learning activity occurs in the third week, hence the peak. These students have never been involved in learning based on wiki, so this evokes great curiosity and interest.

The assignment activity reaches its peak in the fourth week. It is actually the assignment (small paper) arranged in the third week and submitted by students for whom it is the first assignment for the course. The assignment module activities increase gradually at three weeks after the course begins. At this point, forum activities decline with the increase of resource module activities and homework.

Teachers' and Students' Bulletin Board System (BBS)

The BBS discussion between teachers and students is a key teaching activity for this course. Through this teaching, information is transmitted and support services are provided.

- Number and content of interaction between teachers and students:

  The course discussion activities are spread over six units and the number of posts on the BBS reached an accumulative total of 743 as shown in Table 2.

Table 2: BBS activities.

Unit name	Planning teaching time (week)	Number of users	Number of posts (including tutors)	Average number of words per post
Curriculum guide	1	22	199 (tutors account for 47%)	125
Unit 1: What is on-line tutoring?	2	24	134 (tutors account for 47%)	269
Unit 2: Administration	3	20	107 (tutors account for 41%)	338
Unit 3: Role and function of tutors	4	20	72 (tutors account for 33%)	308
Unit 4: Establishing an on-line tutoring style	5	23	94 (tutors account for 42%)	395
Unit 5: Dealing with problems	6	21	80 (tutors account for 40%)	246
Unit 6: Large paper	7, 8, 9	17	56 (tutors account for 39%)	202

Table 2 shows that the postings by tutors slowly decline. The first two weeks of teaching, c*urriculum guide* in the first week and *Unit 1: What is the on-line tutoring?* in the second week, required teachers to spend more time in guiding and counselling students. According to the data, from the third week, postings by tutors begin to fall from about 50% to 40%. This is because teachers have performed effective guidance in earlier weeks. From the third week, tutor posts reduce in number to leave students more time for autonomous activity and discussion. This implies tutors have successfully performed their roles.

- Content of the posts in the interaction between teachers and students:

The extraction algorithm of Fu et al was used to extract 240 terms from the posts, as shown in Table 3 [10]. The frequency of these terms was 4,909 (including 976 for tutors, accounting for 20% of the total). They appeared in 481 posts (including 204 for tutors), accounting for 65% of the total number of posts. On the other hand, there were about a third of posts without any terms. Thus, the main function of BBS was to facilitate a discussion of curriculum knowledge, while the secondary function was to inspire and maintain students' motivation and to encourage students to attend to their study.

Table 3: High frequency terms in BBS posts - the top 20.

BBS posts	Frequency
Tutors	340
Radio and Television University	330
On-line learning	218
Open education	200
On-line tutoring teachers	176
Distance education	114
On-line teaching	114
The Open University	112
On-line tutoring	89
Learners	88
Greeting	84
The Central Radio and Television University	76
Basic Level TV University	65
Autonomous learning	62
Posts	58
Network learning	51
Teaching activities	48
Network teaching	48
Learning	47
On-line tutoring	43

In the top ten terms, *tutoring* appeared three times and *on-line (distance)* four times, which reflects the characteristics of this course; namely, on-line tutoring. The top two are *tutors* and *Radio and Television University*, which reflects the training content. Without exception, training was from the TV university system. Hence the attention paid to this system. In addition, they were concerned about tutors. According to these terms, the BBS discussion was successful and the course was able to satisfy the students.

Frequency statistics of common words were analysed. The words included verbs and nouns but not empty words and terms. The words reflected the language and tutoring characteristics of tutors. The most popular used words were *classmates, come on, students, thank you, can, learning, motivational support provided by tutors for students.* Tutors never forgot to encourage and support a student, and always showed thanks in their discussion through words, such as *come on* and *thank you*.

- The interaction between teachers and students:

The dynamic process and structure of the interaction between teachers and students can be inferred from the time distribution of alternating posts between teachers and students, and an analysis of the network connecting teachers and students. The training course has six units and a paper guide (which actually makes it seven units). The planned teaching time is one week per unit for a total of six weeks. Ideally, students should complete activities for a unit within the prescribed time, but that is not always the case. For example, the work required by a unit often lasts three weeks before its final end. The distribution of discussion activity over time for each unit is shown in Table 4.

Table 4: Distribution of discussion activity over time by unit.

Week	Unit 0 postings	Unit 1 postings	Unit 2 postings	Unit 3 postings	Unit 4 postings	Unit 5 postings	Unit 6 postings	Total
1	91*	3						94
2	34	69*						103
3	13	58	55*					126
4		1	37	30*				68
5		3	14	19	58*	1		95
6			1	14	32	48*	3	98
Week +7	1			8	2	28	31*	71
Week +8	3			1	2	2	10	18
Week +9	2					1	11	14

The number with an asterisk, i.e. "*", in Table 4 is the number of posts within the specified learning time for a unit. But, after the specified learning time, there are still new posts for the next two to three weeks. So, from the beginning of unit 3, there will be three concurrent unit activities. This kind of superposition of activities may be caused by the conflict between working and learning, i.e. students who cannot finish a learning activity in the scheduled week defer the activity. In fact, this is understandable and it also requires that the on-line teaching be flexible. The assignment (small paper) appears in the third week, increasing the burden on students. It is just as the old work and new work coincide that this overlay phenomenon occurs. Of course, this will increase the burden on tutors.

- The structure of the interaction between teachers and students:

  An analysis of ego-centred networks was used to define the social network for teachers and students [11]. Using the post and reply relationship between teachers and students, with the help of social network analysis tool UCINET, a network diagram of the interaction between teachers and students was developed, as shown in Figure 2. It can be seen from the figure that all 24 members, including the tutors - represented by the square nodes - are in the network and there are no isolated members.

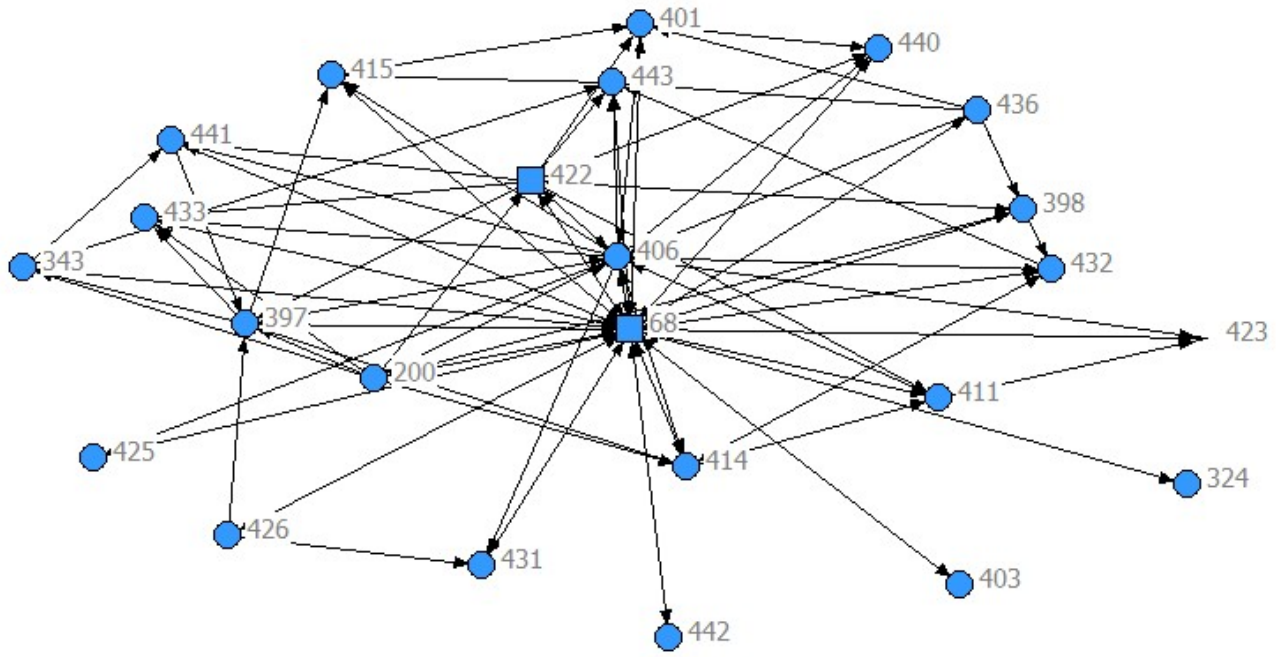

Figure 2: Interaction network between teachers and students.

CONCLUSIONS

The work discussed in this article considered on-line courses using the Moodle platform, and applied learning analysis technology, from the perspective of a guidance teacher. On-line teaching reflection, based on the record of the learning process, was analysed and a new form of teaching reflection was explored.

The research showed that analysing the interaction between teachers and students with study analysis technology can represent the process of on-line learning. This helps teachers better grasp on-line teaching, including teaching activities

and the details of each student. Originally vague impressions are brought into sharp focus, enabling teachers to identify merit and shortcomings in the teaching, resources, study guide and evaluation.

The selected research sample is limited and concerned with small-class teaching. The work needs to be verified using more samples of wider scope. However, the research method should be introduced to improve the reflection of teaching by the gathering and analysis of data.

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