Analysis of Online Learning Behaviour from a Tutor Perspective: Reflections on Interactive Teaching and Learning in the Big Data Era[1]

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Abstract

In the field of education in China, a large number of learning management systems have been deployed, in which vast amounts of data on learners and learning processes have been stored. How can one make use of these data? How can one transform the data into information and knowledge that inform decision-making in teaching and optimize learning? These questions have become a matter of concern for educators and learners. Learning analytics helps to unlock the value of the learning process data, so that the data can become an important basis for prudent decisions and process optimization. 'Learning analytics' was listed in the 2013 NMC *Horizon Report* as one of the emerging technologies that will have a great impact on learning, teaching and innovative research in higher education in two to three years. The report notes that learning analytics aims to decipher trends and patterns in the teaching and learning process from educational big data. In this paper, an online course on the Moodle platform is used for the research. The study examines reflection on online teaching and learning based on massive records of the learning process from the perspective of a tutor employing learning analytics. It is a brand new form of reflection on teaching and learning. The analysis of interactive course forums can help tutors to focus on key teaching and learning activities, and achieve more accurate analysis than with conventional face-to-face teaching activities. The research indicates that learning analytics is effective in supporting tutor reflection on interactive online teaching and learning.

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Introduction

Since 2011, the rapid development of MOOCs (massive open online courses), led by the top conventional universities in the United States, has undoubtedly set a good example of 'online learning'. The model shows that online learning cannot be effective until the university curriculum, the classroom teaching, the learning process, students' experiences, and the teacher-student interaction process are completed as a system online (Li, Zhang & Huang, 2013) — and, in particular, the support from tutors and related guidance activities are satisfactorily achieved. Online learning is not purely autonomous learning, but requires giving full play to the leading role of tutors.

In online learning, teacher-student activities are relatively separate in time and space. Although they can be synchronous, the teaching activities are more often asynchronous which facilitates better the personalization of learners' needs. It is difficult for teachers to grasp the whole picture of learners' development in an online course compared with traditional face-to-face classroom teaching. However, it is possible for teachers to learn more about the process of teaching through the records of the learning process on an online learning platform; and it is essential to reflect on these records for the continuous enhancement of online teaching.

Literature Review

In 'teaching reflection', as the name suggests, the objective is to reflect on the teaching process, and the basis of reflection is a faithful record of this process.

Posner (1989) proposed a formula for teacher growth by combining the growth and development of teachers and their reflections on their own experiences — Experience + Reflection = growth — which indicates the importance of reflection in the professional development of teachers.

Wang and Zhao (2006) point out that teaching reflection refers to a positive cognitive process of teachers' dialectical negation of their teaching philosophy, teaching experience and teaching behaviour through introspection, experience and monitoring — with the aim of improving teaching. The reason why great importance is attached to teaching reflection lies in the requirement to improve teachers' job performance, transform professional teacher education and rationalize teacher training.

In recent years, learning analytics has been viewed as a powerful learning tool for teachers in online teaching reflection. Learning analytics deciphers massive amounts of data generated in the learning process. It helps to assess students' academic progress, predicts their future performance and identifies potential problems (Johnson, Adams & Cummins, 2012). For teachers, learning analytics can be used to carry out a more in-depth analysis of the teaching process so as to provide more targeted teaching interventions for students on the basis of data analysis (Chen, Heritage & Lee, 2005). In online learning, an online learning platform keeps detailed records of students' behaviour, like classroom teaching videos. With learning analytics, data analysis of the behaviour of teachers and students reproduces the online learning process, so that teachers can grasp the whole picture of the online teaching process and understand every aspect of teaching, significant teaching and learning activities, and details of all the students. Thus, the original vague impression will be digitalized and clarified, and teachers will be pushed to reflect on the advantages and disadvantages of their teaching and learning design, resource production, learning guidance and learning assessment.

A Moodle-based online course was selected as a sample. Studies have been conducted into online teaching reflection based on the records of the learning process from a tutor perspective. Learning from the practice of dealing with Moodle data by Romero, Ventura and Garcia (2005), this research employs learning analytics — including specifically discourse analysis and social network analysis, data mining methods of statistical analysis and visualization, clustering, forecasting, relationship mining and text mining, and tools of SQL SERVER 2005 analysis service (SSAS), SPSS, UCINET, EXCEL and ICTCLAS (a Chinese word segmentation system) (Wei, 2013) — to conduct online teaching reflection on records of the learning process from the

perspectives of a tutor, thus exploring a brand new form of reflection on teaching and learning.

Research Sample

A training class of online education practitioners was selected as the research subjects. The training project, organized by the Open University of China (OUC) (the former China Central Radio and TV University) is based on a OUC Moodle platform (website: http:// etutor.ouchn.edu.cn). Three purely online courses (Han, 2011) were used for the training project: *Student Support*, *Tutoring Online* and *Online Course Design*. [2] Each course lasts for six weeks, and students carry out online learning through Moodle with tutors tutoring online throughout. The fifth class of the course *Tutoring Online* was chosen as the sample.

The fifth class of *Tutoring Online* consisted of 23 learners, 80% of whom were born in the 1970s, and one tutor. A key feature is that different groups came from different local radio and TV universities. The training started on May 3, 2011 and ended on June 12, 2011, covering six weeks, except for the time for summative paper-writing. The collection of the training data took longer than the training itself, i.e. from March 1, 2011 to December 31, 2011.

It should be noted that in the course *Tutoring Online,* there is only one teacher-tutor, in this case Han Yanhui (the first author of this paper), who has been engaged in distance education and online learning for over ten years and has accumulated a wealth of experience in teaching/tutoring online. The learners on the course are in-service teachers, who may be referred to as 'teachers-as-learners'**.**

Data Analysis and Reflections on Training

The log data table on Moodle (named 'mdl_log') keeps the records of the platform modules visited, and the various operations and times of

[2] The three online courses were co-developed by the Open University of China and the UK Open University in 2008, targeting online education practitioners. Up to May 2013, the enrolment reached 1,468 and learners were from 20 e-colleges of conventional universities, 56 local radio and TV universities, and ten corporate e-learning institutions.

behaviour of every user; and, using the log data tables and other private data tables, statistical and cluster analysis were conducted on the overall situation. The results of the analysis were then represented visually. On this basis, discussion and reflections were carried out on the course itself and how the fifth training class operated.

Discussions by students and the tutor in forums serve as a key teaching activity for such inquiry-based learning. Through activities, related teaching information is delivered, a variety of other teaching activities are carried out, and the curriculum knowledge is constantly presented, with learning support offered. For that reason, the authors decide to focus the analysis on interactive forums, including the 'structure of interactions', the 'quantity and content of interactions' and the 'dynamic process of interactions'.

Structure: Network of Interactions between the Tutor and Learners (NITL)

Figure 1 below shows the learner-tutor interactive network, based on the relations between posting and replying by learners and the tutor using the UCINET social network analysis tool. As can be seen in the figure, all 24 members (including the tutor, as the square node number 68) are in the same network, and there is no isolated member.

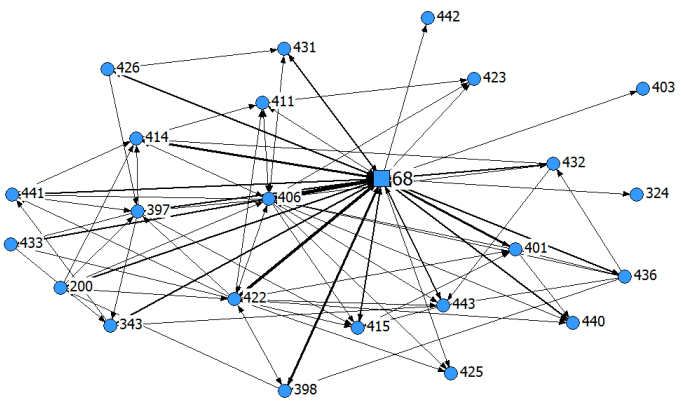

Figure 1 The network of interactions between learners and the tutor

In UCINET, the density analysis along Networks-Cohesion-Density-Density indicates that the density reaches 0.97, almost equal to

1, which implies that each member responded to all the other members once and received one reply from all the other members.

The number of other nodes linked directly to a node in a network figure reflects the authority and influence of a node in the network. The node with the higher centrality stays at the heart of the network, and has the power to effectively control and influence the activities of other actors; and, in contrast, the node with lower centrality is marginalized, rarely participates in interactive communication and has very little impact on other nodes.

In UCINET, the centrality analysis along Networks-Centrality-Degree ('Treat data as symmetric', and select 'NO', i.e. an asymmetric network) suggests that, as shown in Table 1, the member with the highest OutDegree is the tutor, number 68, which indicates that the tutor is the primary participant in the community. According to the NrmOutDeg (relative OutDegree) and NrmInDeg (relative InDegree) analysis, the NrmOutDeg and NrmInDeg of seven members (including the tutor) — namely numbers 68, 406, 422, 414, 200, 401 and 432 — are higher than 1. This shows that the OutDegree and InDegree of all these seven members are higher than the maximum possible degree of the node in the figure, which means that they replied to half the members of the network, and got replies from half the members. These seven acted as opinion leaders in the community. They not only had their own ideas, spoke up, and were more influential, with more replies following their threads, but they also made more replies to other learners; and, hence, their NrmOutDeg and NrmInDeg in the figure are relatively higher. Among them, member 406 was the most active. Despite her being senior in age, she was particularly strong on teaching and academic research, and so it was reasonable for her to be second only to the tutor as an opinion leader. Her outstanding performance promoted enthusiasm among the other learners, and she played a supporting role to the tutor to a certain degree. Therefore, in online teaching and learning, tutors ought to be good at discovering and guiding such opinion leaders among learners as this definitely benefits further development of learning and discussion.

Table 1 OutDegree and InDegree of learners in NITL

Order	Learner No.	OutDegree	InDegree	NrmOutDeg	NrmInDeg
1.	68 （Tutor)	297.000	143.000	30.030	14.459
2.	406	56.000	65.000	5.662	6.572
3.	422	51.000	45.000	5.157	4.550
4.	414	23.000	35.000	2.326	3.539
5.	200	16.000	20.000	1.618	2.022
6.	401	16.000	20.000	1.618	2.022
7.	432	11.000	17.000	1.112	1.719
8.	398	9.000	23.000	0.910	2.326
9.	436	8.000	11.000	0.809	1.112
10.	443	8.000	16.000	0.809	1.618
11.	411	6.000	8.000	0.607	0.809
12.	431	6.000	10.000	0.607	1.011
13.	441	6.000	13.000	0.607	1.314
14.	397	5.000	16.000	0.506	1.618
15.	426	5.000	12.000	0.506	1.213
16.	343	4.000	11.000	0.404	1.112
17.	415	3.000	20.000	0.303	2.022
18.	433	3.000	13.000	0.303	1.314
19.	440	2.000	12.000	0.202	1.213
20.	324	1.000	5.000	0.101	0.506
21.	423	0.000	7.000	0.000	0.708
22.	403	0.000	4.000	0.000	0.404
23.	442	0.000	1.000	0.000	0.101
24.	425	0.000	9.000	0.000	0.910

Betweenness centrality measures a person's capacity as a medium. The higher his/her betweenness centrality, the more people are in contact through him/her. In UCINET, the betweenness centrality analysis along Networks-Centrality-Freeman Betweenness-Node shows that the tutor's betweenness centrality is the highest, and the betweenness centrality of teachers-as-learners is significantly lower than that of the tutor (as shown in Table 2). This suggests that the tutor not only acted as a 'leader' in the interactive learners-tutor network, but also carried out the important role of 'betweenness', actively coordinating

communication between different members of the community. A few learners, such as numbers 422, 397, 414, 401 and 443 also played the role of 'betweenness' to a certain extent. The comparison between Table 1 and Table 2 implies that, although the OutDegree and InDegree of two members —397 and 443 — are not high, their betweenness centrality remained excellent, which shows that more members were able to establish contacts through them.

Table 2 Betweenness centrality of learners in NITL

Order	Learner No.	Betweenness	nBetweenness
1.	68（Tutor）	282.283	55.787
2.	406	41.283	8.159
3.	422	12.083	2.388
4.	397	5.200	1.028
5.	414	2.583	0.511
6.	401	2.333	0.461
7.	443	2.083	0.412
8.	343	1.500	0.296
9.	200	1.367	0.270
10.	415	1.333	0.264
11.	441	1.200	0.237
12.	398	0.750	0.148
13.	411	0.667	0.132
14.	431	0.500	0.099
15.	433	0.500	0.099
16.	432	0.333	0.066
17.	403	0.000	0.000
18.	423	0.000	0.000
19.	324	0.000	0.000
20.	436	0.000	0.000
21.	425	0.000	0.000
22.	426	0.000	0.000
23.	442	0.000	0.000
24.	440	0.000	0.000

Quantity and Content of Interactions between the Tutor and Learners

The discussion activities on the course covered all six learning units. The threads of the class totalled 743, among which there were 727 threads in Chinese and 16 in English, which. indicates the existence of bilingual teaching. Four teacher-as-learners participated in discussions in English. It was not easy for them to post messages in English, and their doing so deserves encouragement.

In terms of age structure, younger learners were more enthusiastic in the discussion activities, though, as noted earlier, the performance of a learner born in the 1960s was outstanding. She had a wealth of teaching practice and strong research capabilities, and made a significant impact in discussions. In addition, an opinion leader born in the 1970s contributed longer threads with a distinctive academic flavour and profound insights. These salient features of the training class were different from those in the previous classes.

Next, interactions between the tutor and learners in the training class were analysed through the quantity and content of interactions.

Quantity of interactive threads by the tutor and learners

The general situation in the forum is shown in Table 3. It shows the slow downward trend of the amount of the tutor' threads. In the first two weeks — Week 1 'Course Guide' and Week 2 'What is tutoring online' — the tutor contributed relatively more to guiding learners' discussions as it was the beginning phase of online teaching. However, from the third week, the amount of the tutor's threads began to decrease from nearly 50% to around 40% because, after the first two weeks' study, the learners maintained a high motivation due to the guidance by the tutor. It is obvious that from the beginning of the third week, the tutor intentionally reduced the amount of threads, paying attention to giving more time for teachers-as-learners' reflection and discussion. The learners began to switch themselves to the leading role in discussions, which illustrates the success of the tutor's grasp and control of the discussion.

Table 3 General situation in the forum

Unit order	Unit title	Planned teaching time	Participants	Topics	Threads (include the tutor's)	Characters of threads (include tutor's)	Replies on each topic	Average characters in each thread
U0	Course Guide	Week 1	22	38	199 (tutor 47%)	24,871 (tutor 45%)	5.2	125
U1	What is tutoring online?	Week 2	24	41	134 (tutor 47%)	36,036 (tutor 19%)	3.3	269
U2	Managing time	Week 3	20	21	107 (tutor 41%)	36,218 (tutor 32%)	5.1	338
U3	Roles of tutors	Week 4	20	14	72 (tutor 33%)	22,149 (tutor 18%)	5.1	308
U4	Establishing tutoring styles	Week 5	23	27	94 (tutor 42%)	37,118 (tutor 17%)	3.5	395
U5	Dealing with difficulties	Week 6	21	24	80 (tutor 40%)	19,671 (tutor 27%)	3.3	246
U6	Paper-writing	Week7,8,9	17	19	56 (tutor 39%)	11,321 (tutor 40%)	2.9	202
Total				**184**	**742 (tutor 321, 43%）**	**187,384**		

Because of the tutor's capacity for controlling and tutoring, the learners always maintained great interest and took the initiative in learning online. From the first week to the end of the sixth week, the number of participants was kept at over 20, with a very high participation rate.

Table 4 shows that 77% of the learners' threads were within 300 words, and 23% were longer, while nearly half of the threads were longer than 100 words. The quantitative distribution of these threads implies the large amount of text, indicating that students were willing to participate in the discussion and express various opinions. Also, the quality of most of their threads was relatively high, with more in-depth discussion on certain topics. In particular, the fact that nearly 25% of their threads

were longer than 300 words suggests the depth of their discussion, which represents the most active learners with their own ideas. Also, that nearly half of the threads were longer than 100 words reflects the situation of most teacher-as-learners' posting and discussing. Their level of participation was relatively high, and they were able to express certain ideas. Overall, this shows the high quality of discussions, the high academic level of learners, and a reasonable length distribution of forum threads in the class.

Table 4 Length of threads by teacher-as-learners

Words	Threads	Cumulative percentage (Total threads 415）
0~99	178	43%
100+	60	57%
200+	40	67%
300+	41	77%
400+	17	81%
500+	19	86%
600+	11	88%
700+	12	91%
800+	3	92%
900+	4	93%
1000+	30	100%

The tutor's language and tutoring in interactive forums

The authors used ICTCLAS (a Chinese word segmentation system) for segmenting the content text of each unit thread, and then counted the frequency of use (FU) of common words from segmentation (including notional words, such as verbs and nouns, and excluding function words and terms) in order to reflect the language and tutoring of the tutor. The top ten common words by FU are shown in Table 5.

Table 5 Top 10 words and their order in units

Words	Rank in U0	Rank in U1	Rank in U2	Rank in U3	Rank in U4	Rank in U5	Rank in U6	FU
Classmate	1	1	1	1	1	1	3	448
Come on	2	3	6	3	6	5	4	193
Student	38	5	2	5	2	2	28	166
Thanks	8	2	18	2	5	4	6	158
You can	6	6	11	71	4	8	2	144
Learn(ing)	3	6	7	8	8	12	119	126
Question	38	4	4		10	3	10	121
Course	5	31	11	15	7	72	16	88
Research	30	172	93	71	169	9	1	78
Discuss(ion)	30	9	3	10	58		119	76

The top ten common words and their ranking in each unit show that the FU of 'classmate', 'student', 'you can' and 'learn(ing)' reached nearly 900 times. Such a frequency is very high, and the words rank higher in each successive unit. The FU of 'classmate', the noun which can be used as a salutation in Chinese, was as high as 448 times, showing the tutor's affection for the learners. He does not regard himself as a teacher, but considers himself as a 'classmate' learning together with all the learners, which narrows significantly the psychological distance between the tutor and learners. The FU of the noun 'learner' is relatively high, which relates to the tutor's philosophy of 'serve learners heart and soul', a learner-centred approach in which all are exploring and solving a variety of problems. The high FU of 'learn(ing)' is easy to understand. 'You can' is actually also learner-centred, encouraging them to express their views and giving them various suggestions to guide their reflection. It is thus evident that the high FU of these four words reflects the tutor's philosophy noted above.

Both the FU and rank of 'come on' and 'thanks' are prominent, which could be interpreted from the perspective of affective support. The tutor's philosophy keeps him encouraging and supporting the ideas expressed and the progress made by each learner. Whether the learners

express wonderful ideas or not, and whether the tutor agrees with them or not, he always expresses his gratitude through 'come on' or 'thanks. Thus, from the beginning to the end, the learners felt psychological comfort and warmth as the tutor provided them with continuing affective support to help them complete their studies.

The use of 'question', 'course', 'research' and 'discussion' is also remarkable, and could be regarded as the grasp of discussion on academic issues and academic research. The tutor focused on 'course' and academic 'research', guiding learners to explore 'questions' and develop the 'discussion'. The tutor not only explored teaching, but also sought the sublimation of theory from the point view of 'research', which reflects his grasp of course content, discussion and research methods by achieving unity of teaching and research. This could be seen as a feature of his tutoring online.

Use of terms

About 240 terms were extracted from the threads by a terminology extraction algorithms developed by Fu, Wei, Wang and Lu (2008). The FU of these terms totalled 4,909 times, including 976 times by the tutor, accounting for about 20%; and these terms appeared in 481 threads, including 204 tutor's threads which accounted for 65% of the total. However, none of these terms was used in about a third of the threads. The main function of the forum was to discuss curriculum knowledge, and the secondary function was to stimulate and sustain the motivation of learners, and to guide and encourage them to keep participating in the study.

Terms used not less than ten times are shown in Table 6.

Table 1 High FU terms in forums

'tutor in Chinese(340); 'dianda'(330); 'online learning'(218); 'open education'(200); 'online tutor'(176); 'distance education'(114); 'network teaching'(114); 'open university'(112); 'tutoring online'(89); 'learner'(88); 'Welcome'(84), 'CRTVU'(76); 'local dianda'(65); 'autonomous learning'(62); 'threads'(58); 'online learning'(51); 'teaching activities'(48); 'online teaching'(48); 'learning guide'(47); 'tutoring for online learning'(43); 'student's learning'(41); 'open and distance education'(41); 'online teaching'(40); 'radio and TV universities(39); 'go online for learning'(39);

‘learning methods’(38); ‘learning process’(38); ‘posting message’(35); ‘way of learning’(34); ‘tutors of open education’(33); ‘study guide for open education’(32); ‘open education of dianda’(31); ‘CRTVU-Online’(31); ‘the Open University of China’(28); ‘formative assessment’(28); ‘research methods’(28); ‘conflicts between work and study’(27); ‘teaching content’(27); ‘teaching resources’(27); ‘courseware’(27); ‘learning environment’(27); ‘learning content’(27); ‘total score’(27); ‘China Central Radio and TV University’(26); ‘facilitator’(25); ‘teaching process’(25); ‘f2f tutorial’(25); ‘f2f class’(24); ‘teaching quality’(23); ‘guiding students’(23); ‘assistant lecturer’(23); ‘teaching mode’(22); ‘course studying’(22); ‘online interaction’(22); ‘dissertation’(21); ‘open English’(21); ‘Wiki’(20); ‘traditional teaching’(20); ‘dianda system’(20); ‘learning resources’(20); ‘supporting service’(20); ‘way of teaching’(19); ‘learning activities’(19); ‘online education’(19); ‘teaching effect’(18); ‘f2f teaching’(18); ‘network tech’(18); ‘study time’(18); ‘instructor’(18); ‘network education’(17); ‘network resources’(17); ‘students’ assignments’(17); ‘online course’(17); ‘online platform’(17); ‘teaching platform’(16); ‘solve problems’(16); three-level platforms’(16); ‘conditions for surfing the Internet(16); ‘forms of learning’(16); ‘course expert’(15); ‘distance teaching’(15); ‘tutor’(14); ‘stimulate students’(14); ‘network platform’(14); ‘academic research’(14); ‘study tasks’(14); ‘teaching management’(13); ‘online teaching activities’(13); ‘literature review’(13); ‘group activities’(13); ‘information resources’(13); ‘student’s learning process’(13); ‘study interests’(13); ‘help students’(12); ‘tutoring class’(12); ‘syllabus’(12); ‘way of assessment’(12); ‘course design’(12); ‘f2f education’(12); ‘group discussion’(12); ‘study skills’(12); ‘traditional f2f teaching’(11); ‘posting’(11); ‘technology coordinator’(11); ‘teacher’s role’(11); ‘project research’(11); ‘learning initiative’(11); ‘learning platform’(11); ‘study conditions’(11); ‘online facilitator’(11); ‘Moodle’(10); ‘pure online’(10); ‘paper’(10); ‘continuing education’(10); ‘teaching design’(10); ‘educational resources’(10); ‘Welcoming for course teaching’(10); ‘assessment system’(10); ‘collaborative learning’(10); ‘learning theory’(10); ‘learning support service’(10)

Note: dianda=radio and TV universities; CRTVU=China Central Radio and TV University.

Based on Table 6, the cloud of the high-frequency terms was drawn, as shown in Figure 2.

Figure 2 Cloud of high-frequency terms

Among the top ten terms, 'tutoring' appeared three times, and 'online (distance)' was used four times. This reflects accurately the characteristics of the course, i.e. tutoring online. The top two terms were 'tutor' and 'dianda', which imply the content of the training and the characteristics of the trainees. The trainees were all from the dianda system, so they are most concerned about this system; and the reason why they chose the course is that they wanted to know how to be a good 'tutor'. As can be seen from these terms, the class discussions in the fifth class were successful, and the course design met reasonably the needs of the learners.

Dynamic Process of Interactions between the Tutor and Learners

We can learn about the dynamic process of learners-tutor interactions from analysing the time distribution of interactive threads.

As noted earlier, the training course consisted of six units and a summative paper-writing task (actually seven units); and the planned teaching period was six weeks, with one unit each week. Ideally, students should complete the activities in the respective units within a fixed time, but that was not the case. Taking 'topic discussion' of each unit as an example, the discussion of a unit lasted for about three weeks before coming to an end. The distribution of discussion activities on each unit over time is shown in Table 7.

Table 7 Discussions distribution in each unit

Week	Threads in U0	Threads in U1	Threads in U2	Threads in U3	Threads in U4	Threads in U5	Threads in U6	Total
-3	1							1
-2	9							9
-1	45							45
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
+7	1			8	2	28	**32**	71
+8	3			1	2	2	10	18
+9	2					1	11	14
	199	**134**	**107**	**72**	**94**	**80**	**56**	**742**

In Table 7, the red figures represent the number of threads within the fixed time for each unit, but it was found that more threads were posted within two to three weeks following the end of a unit. Therefore, from the beginning of Unit 2, the third unit, the activities of three units were overlaid, which explains why the frequency of the learner and tutor activities in Week 3 reached the peak. This overlay phenomenon may be due to the conflict between work and study. The learners could not complete the activity for each week in time, and so there was a delay. In fact, this is understandable from the perspective of learners, and also requires us to provide a certain flexibility in teaching online. At the same time, Week 3 was when the first assignment (essay-writing) was due, and the burden on learners began to increase. Such overlays also increased the demands on the tutor.

We analysed the time interval of the replies by the tutor to learners (reply time minus posting time, unit='day'), and determined the timeliness of replies by the tutor. There were 297 replies by the tutor to learners, totalling 73% of all the replies to them. In total, there were 403

replies to learners, including replies by learners to learners. The replies by the tutor during all the weeks are shown in Table 8.

Table 8 Tutor's replies each week and their intervals

Week	Replies	Average intervals (Unit: day)
- 3	1	8.9
- 2	6	5.0
- 1	16	1.2
1	42	0.5
2	58	1.0
3	48	0.7
4	17	1.0
5	42	1.6
6	40	0.9
+ 7	18	0.6
+ 8	5	0.8
+ 9	4	0.1

In the fixed teaching weeks (from Week 1 to Week 7), the average interval for the replies by the tutor was 0.90 days, with 208 replies (70% of all replies) completed within 24 hours. As can be seen from the data, the tutor's replies were timely, i.e. basically within a single day. Taking into account the fact of crossing the night, the timeliness for the replies by the tutor is very high. During the daytime, as long as the tutor was free, he tried to complete replies within half an hour following a new thread reaching his e-mail box.

Reflections and Conclusion

Reflections

Through tutoring the fifth class, Han Yanhui, the tutor, believes that the vast majority of teachers-as-learners are very active in learning and participating in discussions. The discussions represent their own ideas and capacity for in-depth analysis. As all the learners in the class are from the radio and TV universities, they are able to identify the current major problems within the system, and actively seek the corresponding

solutions. This reflects their concerns and sense of responsibility, their liking for the system, and their enthusiasm for the transformation to web-based teaching. There is a strong feeling that they are particularly eager to learn about the latest achievements in teaching and research, as well as new teaching philosophies, in modern international distance education. For instance, they were very interested in the UK Open University, and tried to compare it with the system of radio and TV universities in China, looking for gaps and discussing ways for improvement. A feature of the grouping was that different groups were from different radio and TV universities; and the more students from the same university, the more helpful it was in promoting an active learning atmosphere since they were familiar with each other.

The tutor, however, discovered a problem with the class. The English literacy of the learners needs to be improved as it is very difficult for them to read the original English materials. Basically, they cannot read them through, let alone the English academic papers offered in the 'Supplementary Reading Materials'. If one wants to learn about the leading teaching philosophies of international counterparts and keep pace with the world, they have to enhance their English literacy. Furthermore, the internationalization of the Open University of China will be difficult to achieve without a major improvement in the English literacy of its staff.

Another prominent issue lies in academic research methodology. Most of the learners need to enhance their knowledge and understanding of academic research methods, qualitative and quantitative. The module on 'Summative Paper-Writing', introduces the structure of academic papers and guides the learners in conducting rigorous academic research. The addition of this module, as part of the localization of the course from the UK Open University, yielded good results.

Conclusion

This paper has focused on a Moodle-based online course. To conduct online teaching reflection upon records of the learning process from the perspectives of a tutor exploring a new form of teaching reflection, the research employed the following: learning analytics; the discourse analysis and social network analysis; data mining methods; statistical analysis and visualization; clustering; forecasting; the relationship

between mining and text mining; and the tools of SQL SERVER 2005 analysis service (SSAS), SPSS, UCINET, EXCEL, and ICTCLAS (a Chinese word segmentation system). It is a brand new form of reflections on teaching and learning. The research indicated that learning analytics is effective in supporting tutors' reflections on interactive online teaching and learning. The analysis of the interactive forums helps tutors to focus on key teaching and learning activities, and achieve more accurate analysis than in conventional face-to-face teaching activities. The quantity and content of learners-tutor interactions, and analysis of the dynamic process in such interactions, gave the tutor an accurate feel for the interaction frequency and keyword usage in different periods, reflecting whether such interactions — the important teaching activity of the course — had been achieved according to the course design. Through the analysis of the structure of the learners-tutor interaction network, the tutor understood accurately the differences in the roles played by different learners in the process of interactions.

References

Chen, E., Heritage, M. & Lee, J. (2005). Identifying and Monitoring Students' Learning Needs With Technology. *Journal of Education for Students Placed at Risk, 10* (3), 309-332.

Fu, Q., Wei, S., Wang, B., & Lu, Q. (2008). The study of automatic term extraction in the field of educational technology. *Modern Educational Technology, 18* (5), 60-65.

Han, Y. (2011). Issues of interaction in a pure-online English learning environment through the perspectives of cognitive constructivism and social constructivism: A case study for non-formal learning. In X. Luo, Y. Cao, B. Yang, J. Liu, & F. Ye (Eds.) *New horizons in web-based learning – ICWL 2010 Workshops*, *Lecture Notes in Computer Science,* (Vol. 6537/2011, pp. 139-150). Springer-Verlag Berlin Heidelberg.

Johnson, L., Adams Becker, S., Cummins, M., Estrada, V., Freeman, A., & Ludgate, H. (2013). *NMC Horizon Report > 2013 Higher Education Edition*. Austin, Texas: The New Media Consortium.

Li, M., Zhang Y., & Huang, Z. (2013, May 30). MOOC: Brewing innovations in higher education. *China Science Daily*, p.. 7.

Posner, G. J. (1989). *Field experience: Methods of reflective teaching.* Longman Publishing Group.

Romero, C., Ventura, S., & Garcia, E. (2005). Data mining in course management systems: Moodle case study and tutorial. *Computers & Education*, *51*(1), 368-384.

Wang, Y., & Zhao, X. (2006). Teaching reflection: Concept, meaning and approaches. *Educational Theory and Practic*e, *26* (02), 53-56.

Wei, S. (2013). Learning analytics: Mining the value of education data under the big data era. *Modern Educational Technology, 23* (02), 5-11.