Contrast experimental study on the application of Wiki and Moodle in on-line education

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ABSTRACT: Wiki is a typical technology under the current Internet environment, one which encourages the user to participate in virtual teamwork to accomplish a certain target. Wiki technology has obvious applicability in network discussions relating to education. In order to verify whether Wiki technology has accelerated on-line education, the author compares two platforms that is Wiki and Moodle, in an experiment, and uses structural equation modelling to verify the applicability of Wiki. It is hoped that this article can both enrich the methodology of the experimental study of education, and be a valuable reference for educational practice.

INTRODUCTION

The concept of an on-line education platform was first raised quite a few years ago. Because of the close attention paid by a large number of institutions and researchers, as well as the great efforts made by practical teachers, an on-line education platform has been developing rapidly in China. Today, when both hardware and software resources have been enriched, the focus of on-line education platforms has shifted from how to build the platform resources, and now looks at how to improve the education results of students who study through this kind of education platform.

At the same time, the teaching methods of the on-line education platform have been expanded comprehensively. The typical on-line education platform can be categorised as teaching education and discussion education. The latter has now been widely adopted in university education as it emphasises the consciousness of students, and can cultivate their cooperation and innovation spirit. The core of discussion education is to improve the interaction between students to accomplish discussions about a series of themes through teamwork. However, during the implementation, the discussions of on-line education cannot reach the expected level of results as they are usually restricted by the virtual communication environment. A common problem is that some students try to take their group's results as their own or some students do not show the initiative to build a team.

Wiki is a typical technology under the current Internet environment. It encourages each user to join the virtual team to work together to accomplish a certain target (for example: collaboration on an article). Each participant can make a contribution according to their knowledge background, as well as editing the work of others (such as making amendments and corrections) that will be presented as part of the article. Take Wikipedia, the most famous application of Wiki technology, as an instance. Its whole content is completely contributed by the mass users for free. It now contains 50 times the information of the Encyclopaedia, while the quality of the information is typically as good as the latter [1].

The reasons why Wiki technology can succeed are firstly, all the participants enjoy equal rights, which mean that the improvement of their status in the teamwork totally relies on their own contributions. Secondly, each contribution is recorded independently, and all the modifications can be shared immediately by the whole team. At present, the discussion modules of university on-line education platforms are mainly designed as BBS (bulletin board systems) and chat rooms. The defects of these are:

1) The discussion process cannot promote teamwork communication. For example, a question asked by a student on BBS may go through many responses before being solved and the questioner has to read all the responses and identify the useful ones. This lowers the level of efficiency. If the question is asked in a chat room, the questioner

has to find the responses to his/her question from among many discussions, and misunderstanding and information losses may quite often occur.

2) The roles of each participant are usually predetermined, which cannot motivate everyone to make a contribution. For example, there will be a team leader predetermined before discussion. So, other team members usually lack motivation to make contributions, as they think most of the teamwork load should be shouldered by the team leader.

3) The latest developments cannot be displayed directly. The team members have to spend a lot of time to process each independent response to get the end result.

This article compares the application of the Wiki platform and the Moodle platform during an on-line discussion education process to evaluate the four sessions' group discussions of 214 students in a course on *Modern Education Technology* of a college and analyses the structural equation modelling of the returned questionnaires. The study results show that when compared to a traditional on-line education platform (like Moodle), the Wiki platform is better at improving students' communication quality, education experience and acquisition quality during education process.

DESIGN OF EXPERIMENT PROCEDURE

At present, the on-line education platforms adopted by Chinese colleges and universities, typically like Moodle and Blackboard, are quite similar. The author has chosen Moodle to be compared with the Wiki platform, since the former is open-sourced and can be obtained for free and its code can be easily deployed. It should be pointed out that the discussion function of the Moodle education platform is realised in the form of BBS. In this experiment, the deployment environments of both platforms are PHP (hypertext pre-processor), Apache and MySQL.

The author used the knowledge module of *The Application of Network Resources in Education* in the Modern Education Technology course as the theme of this experiment. The reasons for choosing this theme are firstly, the theme is suitable for learning through on-line discussion. Secondly, the content of this knowledge module can motivate students' interest in study. The on-line study activity mode integrates the initiative study and cooperative discussion. Before the activity starts, the teacher may provide relative resources for this theme. After entering this activity, students can study these resources and use networks to search, process and digest the information before participating in the discussion. The discussion has four topics, *pirate software*, *on-line privacy*, *freedom of speech* and *on-line games*.

Each topic was discussed for a week. All the student participants received 30 minutes' training to ensure they could use the systems well before use. The teachers also participated in the whole process of the activity. They only needed to give instructions and coordinate opinions when necessary. Before starting each topic, students were randomly divided into two teams to use the Wiki and Moodle platforms, respectively. They were asked to discuss on-line and write a summary report that required the following:

- The members of each team should accomplish the topic discussion through the network. The outcome of the discussion was to be a high-quality discussion summary report.
- All the work should be done in text. Video and voice communication were not allowed.
- Each member should search information on their own and express their opinions from the aspects of neutral, supporter and objector; for example, provide arguments of both the positive and negative influences of an event.
- Each member could only modify others' content when they were not objective enough (such as, being too absolute or placing too much emphasis on the positive/negative elements of a case) or when there is a typographical error, unclear expression, etc. When members have different opinions, they should only add new content to describe their opinions, instead of deleting the content contributed by others.
- Each member has the right to make additions and modifications to the content provided by others.
- Each team should process the information and write a summary report on the last two days of each discussion.

To prevent plagiarism, the Wiki and Moodle teams were isolated from each other during the work. In both systems, students participated in the discussion under on-line nicknames in order to prevent off-line interferences with each other (the corresponding student ID to each on-line nickname is visible to the teachers only). The author evaluated the quality and quantity of content provided by each student during discussion and the contribution to the final report to grade their performances. Two other teachers who are familiar with this course were invited by the author to evaluate the quality of the final report. Under this methodology, the final report of the discussion is graded as the average mark of the marks given by the three teachers.

THEORETICAL MODEL OF THE EXPERIMENT

In group discussion, as all the materials discussed are sourced from students' participation in the activity, students' action, including material preparation and the quantity and quality of submitted content, will directly influence the performance of the team. The more frequently and richer content of the students communication, the better the final report of the team will be (Assumption 1).

Students will create an invisible discussion atmosphere during their participation and team members will become familiar with each other in the process, so that the communication efficiency of the team can be promoted (Assumption 2).

The team with higher communication efficiency can fulfil their discussion task in a more efficient way, such as coordinating different opinions during discussion with higher efficiency, so that the team can produce better outcomes within the same time period (Assumption 3).

On the other hand, from the aspect of individual students, active participation means more material contribution and larger influence within the team (Assumption 4).

In general, students with larger influence in the team enjoy higher prestige. When there are different opinions, their opinion will be more favoured by others, so that the communication efficiency is improved (Assumption 5).

Apart from this, when students find that their opinion is usually accepted by the team, there will be positive influence to their own mental development. They will proactively contribute more and better content in order to maintain or improve their status within the team. Therefore the outcome of the whole team can be promoted (Assumption 6).

To sum up, the theoretical model of this study is shown in Figure 1.

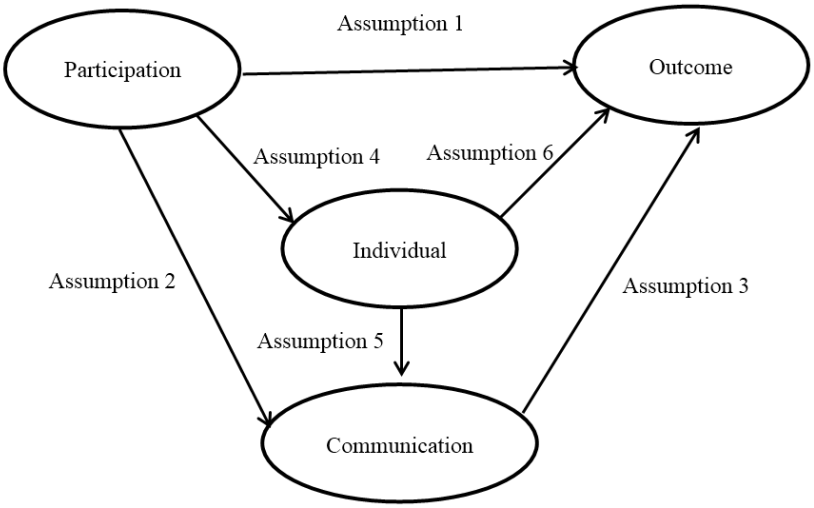

Figure 1: The theoretical model adopted in the experiment.

TOOLS AND OBJECTS OF THE EXPERIMENT

Questionnaire Design

The questionnaire was built around a Likert five star rating scale, level 1 to level 5 representing *strongly disagree* (very low), *disagree* (low), *neutral* (middle), *agree* (high), *strongly agree* (very high). The questionnaire mainly focuses on the measurement of four dimensions, i.e. participation level, communication efficiency, communication quality and outcome quality as shown in Table 1. All the questions are based on the relevant literature by various organisations [2][3].

Table 1 Content of the questionnaire.

Measuring dimension	Measuring questions
Participation level	Please describe the time and effort you spend on this topic. Please describe the frequency of your contribution to the group discussion. Compared to other team members, what do you think of your contribution level?
Individual influence	How do you evaluate your influence in the discussion process? Please describe the acceptance level of your opinion in the final report. Are you satisfied with your performance during the group discussion?
Communication efficiency	To what degree can the final result satisfy everyone when there is a divergence? When there is opinion division, how fast is the problem solved? Generally speaking, are you satisfied with the degree that the problem is solved during the discussion?
Outcome quality	From the aspect of quantity, how do you think of the outcome of your team? From the aspect of quality, how do you think of the outcome of your team? What do you think of the communication efficiency of your team? Do you think your team members learn relative knowledge about the topic during the discussion?

Structure of Survey Samples

There were 214 students participating in this experiment, comprising 126 men and 88 women. The questionnaires were given out after each discussion and before the next discussion, so as to guarantee that the result would reflect the real condition of the discussion. In each discussion, there were a few students who seldom participated in the discussion. In order to guarantee the outcome quality of the next discussion, the author eliminated a few students whose participation level was very low. After four discussion sessions, 856 questionnaires were given out, and 828 were returned, with an effective return rate of 96.7%. The high return rate was mainly due to the distribution of questionnaires on-line, and each question was controlled by the program to disallow missing returns. Students were also given sufficient time to fill in the questionnaire, so as to lower the possibility of casual answers. The 3.3% of *ineffective* questionnaires occurred because a few students quit the experiment due to personal reasons (e.g. asked for sick leave) and they, therefore, did not fill out the questionnaire.

ANALYSIS ON THE SURVEY RESULT

The survey results were analysed through structural equation modelling, which has been widely used in sectors like enterprise management, marketing, and so on. The analysis software packages used were SPSS13 and Warp PLS2.0.

Analysis of the Measuring Model

The analysis of the measuring model was carried out from the following three aspects: a) individual reliability, reflected from observing the reflection of variables on the load of potential variable factors in factor analysis; b) internal consistency, reflected from composite reliability and Cronbach α of potential variables; and c) discriminant validity, reflected from the extracted average variance of potential variables [4].

During the factor analysis, the rotating factor matrix separates four factors, which is equal to the number of the potential variables in this experiment. The load value of each measuring question in this dimension all exceed 0.5, and is larger than the load value in other dimensions, which complies with the requirement of individual reliability. The internal consistency requires the composite reliability and Cronbach α value of each potential variable to exceed 0.7, while discriminant validity requires the AVE value of each potential variable to exceed 0.5. The internal consistency and discriminant validity requirements of this questionnaire are shown in Table 2.

Table 2: Reliability and relative coefficient of potential variable.

	Potential variable	Structural reliability	Cronbach α	1	2	3	4
1	Participation level	0.996	0.991	(0.996)			
2	Individual influence	0.843	0.763	0.728	(0.724)		
3	Communication efficiency	0.953	0.901	0.409	0.473	(0.954)	
4	Outcome quality	0.831	0.822	0.654	0.650	0.419	(0.837)

Note: The values on the diagonal line of the half angle matrix are AVE values. Others are relative coefficients of potential variables. All the relative coefficients' significance levels reach $p < 0.01$

Analysis of the Structural Model

There are three indicators to balance the adaptation degree of the whole model in the PLS analysis: average path coefficient, average Chi-square value (R2) and average variance inflation factor. In general conditions, the significance level of average path coefficient and average Chi-square value should reach $p < 0.05$, while the average variance inflation factor should be lower than 5 [5]. In the model studied, the average path coefficient was 0.410 and average Chi-square value was 0.526. The significance levels of both values reached $p < 0.01$. The average variance inflation factor was 2.10, which showed that there were no severe collinear problems among the measuring items. Therefore, one can judge that this model can well reflect the real conditions of students' discussion. The author analysed the two sets of data from the Wiki and Moodle platform questionnaires.

In the Wiki team, the participation level was notable and exerted a positive influence on individual influence ($\beta = 0.67$, standard deviation = 0.081), communication efficiency ($\beta = 0.15$, standard deviation = 0.016) and outcome quality ($\beta = 0.19$, standard deviation = 0.034). Individual influence was notable and exerted a positive influence on communication efficiency ($\beta = 0.21$, standard deviation = 0.054) and outcome quality ($\beta = 0.22$, standard deviation = 0.097). Communication efficiency was notable and had a positive influence on outcome quality ($\beta = 0.42$, standard deviation = 0.063). The interpretive degrees of individual influence, communication efficiency and outcome quality were 60%, 51% and 47%, respectively. Therefore, the modelling Assumptions (see Figure 1) were all valid in the Wiki team.

In the Moodle team, the participation level was notable and had a positive influence on individual influence ($\beta = 0.27$, standard deviation = 0.085) and outcome quality ($\beta = 0.17$, standard deviation = 0.039). But, for communication efficiency, its influence was not notable ($p > 0.05$). Individual influence was notable and had a positive influence on

outcome quality ($\beta = 0.20$, standard deviation = 0.030), but this was not obvious on communication efficiency ($p > 0.05$). Communication efficiency was notable and has laid positive influence on outcome quality ($\beta = 0.12$, standard deviation = 0.061). The interpretive degrees of individual influence, communication efficiency and outcome quality were 49%, 27% and 33%, respectively. Therefore, except for Assumptions 2 and 5 (see Figure 1), the modelling Assumptions were all valid in the Moodle team.

Outcome Quality

Three teachers integrated and evaluated the eight discussion reports of the two teams from the aspects of comprehensiveness of content, neutrality of opinions and normalisation of language. The three teachers graded the report independently. The quality marks of the four reports of the Wiki team were 7, 6.83, 7.33 and 7, respectively, while of the Moodle team they were 6.16, 5.5, 5.16 and 6.33. So, the final reports of the Wiki team were of a higher quality.

CONCLUSIONS

Through research carried out and presented in this article, it was found that the diversity of platforms has a significant effect on teaching efficiency. A cooperative platform like Wiki can promote the communication efficiency of the discussion team and lead to better outcomes. It can also help students to establish teamwork spirit, provide positive feedback of individual contribution and mental (knowledge) response, so as to accelerate knowledge exchange, which is consistent with the current teaching concept.

From the aspect of students' participation level, one can see that after one discussion session, the participants of the Wiki platform were more willing to engage in discussion on the next topic. On the other hand, those involved with the Moodle BBS platform did not present good teamwork communication efficiency. Although their individual contribution had improved, the improvement of their virtual status in the team did not demonstrate the communication efficiency of the whole team, nor could they get a high-quality outcome. The post-survey discussion also showed that students prefer to use the Wiki platform for cooperation and study.

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