

The Differences of Group learning in the Classroom-based and the Web-based Environments: Factor Analysis

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ABSTRACT

The purpose of this study is to examine the differences of group learning (GL) in the classroom-based and the web-based environments through factor analysis. Our previous study has already identified 62 influencing factors of a GL process according to the content analysis from the literature. 276 teachers participated in a well-structured questionnaire survey and the data were analysed by SPSS. Four main factors were extracted and ranked according to their weightings. The findings reveal that there are differences of GL between these two environments, and two main factors are in the different positions for different environments. The interdependent relationship of these four main factors is described as a framework of a GL process.

Keywords

Group learning, factor analysis, classroom-based environments, web-based environments.

INTRODUCTION

The classroom-based environment is a traditional learning environment which provides teachers and students the convenient opportunity for Face-to-Face (FTF) interaction (Wallace, Venville, and Chou, 2001; Comeaux, McKenna-Byington, 2003; Rovai, 2001). With technology development and popularity over the past decade, the web-based environment has been popularly used in the educational field where it offers us the communication opportunity without the time and space limitation (Khan, 1997; Kearsley, 2000; Jolliffe and et al., 2001). Researchers have already explored many issues for these two environments, such as classroom behaviour (Erdle and et al., 1985), group work (Gillies, 2003), knowledge construction (Schuh, 2003), web-based collaborative learning (Hron & Friedrich, 2003), and blended learning (Alonso and et al., 2005; Joseph & Nancy, 2004). We addressed our study in examining the differences of these two environments through analysing the influencing factors of a GL process which were derived from our previous studies (Zhao & McConnell, 2004).

Some researchers' work related to this study, for instance, McConnell (2000) analyses the differences between teaching and learning in CSCL and face-to-face (FTF) groups, and his description provides an overall and comprehensive perspective for this issue; Burke (2001) explores how the learning environments (FTF vs. distant) and task difficulty level (simple vs. difficult) influence participation level and social presence among students working collaboratively; Jonassen and Kwan (2001) compare the perceptions of participants, the nature of the comments made, and the patterns of communication in FTF and computer-mediated groups in terms of problem-solving activities while solving well-structured and ill-structured problems; Newman and et al. (1996) conduct an experiment to compare the quality of learning in seminars via FTF and the network Telepathy computer conferencing system; Bluemink and Sanna (2004) explore the role of FTF encounters as contextual support in an international teacher education course based on a pedagogical model – shared perspectives in a virtual environment (SHAPE) and the findings show that the students were engaged in a rich variety of interactions during the face-to-face encounters and the students' activity in the Web-based environment remained on the same level throughout the course. Our study explored the fundamental issue in this area, which is to find out the difference of GL in the classroom-based and the web-based environments. Actually, the previous work (McConnell, 2000; Burke, 2001; Jonassen & Kwan, 2001; Bluemink & Sanna, 2004; Newman & et al., 1996) in the field does not really relate to the difference of GL in these two environments. In this study, we explored a way to express the difference of GL systematically.

Consequently, we address the purposes of this study to find out the differences of GL through its influencing factors in the classroom-based and the web-based environments. The results may be able to use to manage these

influencing factors, particularly in a blended e-learning environment. Meanwhile, we try to examine the weightings of these influencing factors and to identify what the differences of GL are. Our previous studies have already identified 62 influencing factors of a GL process through content analysis from the literature, which is the prerequisite of this study.

METHODS

We assume that these influencing factors would relate to the different environments where they can be used to describe the differences of a GL process. A well-structured questionnaire survey is employed to collect the relevant data and factor analysis is used to analyse them in this study.

Questionnaire Design

The questionnaires were designed as Likert-scale according to the influencing factors of a GL process, in which the questions and 5 point-scale (i.e. strongest necessary, necessary, neutral, not necessary, and weakest necessary) constitute a matrix, which an example is given in figure 1.

Group Behaviour	Classroom-based setting	€	€	€	€	€
	Web-based setting	€	€	€	€	€

Figure 1 an example of the questionnaire

Each question is related to two environments in the matrix. In order to ensure participants understand the meaning of each question exactly, the terms of the questions (such as “Group Behaviour”) were interpreted as the notes of the questionnaire.

Pilot Study

Before the formal questionnaire survey was approached, a pilot study was used for testing the validity of the questionnaires. 10 teachers were chosen from South China Normal University (SCNU) and Guangdong Technology Normal University (GTNU). Respondents’ feedback illustrated that the structure of the matrix of the questionnaire was quite useful for them to tick in the cells according to their own opinion. The notes in the appendix were helpful for them to understand the meaning of some specific terms in the questionnaire. Few expressions and typographical mistakes needed to be revised.

The big change was made after the pilot study was that the “filter question” was added to the questionnaire, such as “do you have experience to use group learning in your class?” and “do you have experience to use group learning in the computer supported environment?”, because few tutors revealed that they did not participate in group learning before. In this study, experienced participants for group learning were the prerequisite for them to participate in the questionnaire. Otherwise, their responses would be invalid to be used for factor analysis. Therefore, the question used for identifying participants’ experience of group learning was necessary to be added in the questionnaire.

Participants

Participants in this questionnaire survey included 330 teachers who came from 6 universities. Table 1 presents the distributed number of samples in different Chinese colleges and universities. Even though most samples were chosen from Guangdong province, the tutors came from all over China. Exclusive GTNU, other universities are all national-level institutions. Therefore, these samples can be considered as being representative of teachers in CHEIs (Chinese Higher Education Institutions).

Table 1 the distributions of samples

Samples	SCNU	JNU	SCIT	GTNU	GFTU	ZSU	Others	Total
Teachers	90	50	30	40	50	30	40	330

In order to choose the valid data, the standards were set up for eliminating the invalid data, which were presented as follows:

- Two filter questions in the questionnaire needed respondents to give their positive reply, such as “Yes, I do”. Otherwise, the reclaimed questionnaire would be invalid.
- Each question in the questionnaire should be answered completely. Otherwise, the questionnaire would be invalid.
- The ticked positions could not be the same scale for a long list, i.e. respondent ticked the same position for many questions. Otherwise the questionnaire would be invalid.

The number of valid cases according to the standards is described in Table 2.

Table 2 the number of the valid cases

Samples	SCNU	JNU	SCIT	GTNU	GFTU	ZSU	Others	Total
Teachers	81	40	22	33	36	27	37	276

Comparing Table 1 and Table 2, the valid number and valid percentage of samples are presented in Table 3.

Table 3 the description of samples

No.	Samples	Total Number	Valid Number	Valid Percentage
1	Teachers	330	276	83.64

Factor Analysis

Foster (2001) states that factor analysis can be defined as a technique or more accurately a family of techniques that aim to simplify the complex sets of data by analysing the correlations between them. It was designed to simplify the correlation matrix and revealed the small number of factors that could explain the correlations. The main outputs of SPSS for factor analysis include the components, re-grouping influencing factors, and the weighting of each influencing factor, which represent the results of the teachers’ responses to GL in the different environments.

DATA ANALYSIS AND DISCUSSIONS

Teachers’ Responses to GL in the Classroom-based Environments

The results of KMO and Bartlett’s test and the screen plot about teachers’ responses to GL in the classroom-based environments were given in Appendix I (the results of KMO and Bartlett’s test and the screen plot for the classroom-based environments), which demonstrate that the accepting value of teachers’ response is great, the Bartlett’s test of Sphericity is significant ($df = 1891, p = 0.000$), and the point of inflexion on the curve of the screen plot begins to tail after 4 factors which indicates that 4 components can be extracted from factor analysis (the extracted main factors and inclusive variables did not provide in this paper).

The variables of the main extracted factor 1 describe the task processing, such as group interaction, group activities, group brainstorming, and group decision; some of them focus on their outcomes, such as group performance, individual contribution, group rewards, and group effectiveness; and some of them are supportive variables, such as group strategies, group dynamics, interpersonal relationship, and group norms. Therefore, component 1 was named as “processing” in order to describe the main feature of these sub-factors, which means participants’ dealing with a problem or undertaking a task in a GL process, such as participants trying the different methods, finding out the related literature, or collecting the relevant data.

The variables of component 2 indicate their socialising tendency, such as group cohesion, group negotiation, group discussion, group communication, and group community. The other variables were the supportive influencing factors for this purpose, such as group maintenance, group agenda, group task, group goal, group assessment, and group structure. Therefore, “socialising” was used to represent this component, which emphasises the participants’ relationship in a GL process, which can be expressed as participants’ discussion, communication, trusting each other, sharing understanding, or constructing to the group work.

The variables of the components 3 represent students who are engaging in the GL activities, such as group works, group action, group motivation, individual attitudes, group awareness, and group planning. Then, “engaging” was defined to explain component 3, which concerns the activities of participants engaging in a GL process, which a status represents participants are real involved the GL process.

The variables of component 4 are related to the property of a group, such as personal identity, group history, group identify, and group composition. Therefore, this component was assigned as “property”, which represents the identity of a group, such as group history, name, or time issues (e.g. maintenance, duration, etc.), which presents the static information of a GL process.

Few variables were rectified for their appropriate loading position, which include group process, group resources, group formation, and group categories. These four factors are all loaded into two components, such as group process belonged to “processing” and “property”. It was adjusted from “property” to “processing” according to its characteristic. The other variables are rectified as well, such as group resource was moved from “socialising” to “property”, group formation and group categories were moved from “engaging” to “property”. The changing of these factors caused their eigenvalues different as well.

These four factors can be expressed as a sequence by the value of their weightings, i.e. “processing (0.4093) → socialising (0.2267) → engaging (0.1991) → property (0.1649)”, which were extracted through factor analysis. The numbers of sub-factors allocated to each main factor (components) describes the same sequence, which presents as “processing (18) → socialising (13) → engaging (12) → property (9)”. This result may reflect the degree to which the components have been dissected and discussed in the literature.

Teachers’ Responses to GL in the Web-based Environments

The results of KMO and Bartlett’s test and the screen plot about teachers’ responses to GL in the web-based environments were presented in Appendix I (the results of KMO and Bartlett’s test and the screen plot for the web-based environments), which demonstrate that the accepting value of teachers’ response is good, the Barlett’s test of Sphericity is significant ($df = 1891, p = 0.000$), and the point of inflexion on the curve of the screen plot begins to tail after 4 factors which indicates that 4 components can be extracted from factor analysis (the extracted main factors and inclusive variables did not provide in this paper).

Four components were extracted from factor analysis and each of them was given a different name according to their inclusive variables. The variables allocated into the first component are “processing”, such as group negotiation, group diagnosis, role playing, group brainstorming, group feedback, and problem solving. The second component presents “engaging”, such as group dynamics, group performance, group activities, and group development. The third component is “socialising”, such as group status, group works, group leadership, group community, and group awareness. The fourth component indicates “property” of GL, such as group history, group rewards, and group identity.

With respect to the variables are loaded into different components at the same time, such as “group environment”, “group cohesion”, “group productivity”, “group interaction”, and “group skills”, they were adjusted and allocated into the appropriate components.

The weightings were assigned to them in terms of the results of factor analysis. The sequence can be identified according to the different weightings “processing (0.3599) → engaging (0.3143) → socialising (0.2560) → property (0.0698)”. If the main factors are ranked by the numbers of the sub-factors allocated into each main factors, a sequence can be expressed as “processing (21) → engaging (16) → socialising (14) → property (4)”. This sequence may reflect the degree of each main factors have been discussed in the literature.

Discussions

Comparing the results of teachers’ response to GL in the classroom-based environments with the web-based environments, the differences of GL in these two environments can be expressed as the difference of the sequences of these four main factors. The positions of “socialising” and “engaging” are changed, but “processing” and “property” are the same positions for these two environments. “Processing” is the most important factor, and “socialising” is the second important factor in the classroom-based environment. When GL is applied in the web-based environments, “processing” has the same position, but “engaging” is the second important factor. “Property” does not change its position in these two environments.

According to these results, “socialising” is more important than “engaging” in the classroom-based environments, but their importance are reversed when GL is used in the web-based environments. Therefore, the

different strategies would be applied to organise GL in these different environments, such as to encourage students involving in the socialising activities in the classroom-based environments and to ensure students more engaged in GL activities in the web-based environments. Wherever in the classroom-based or web-based environments, “processing” is the priority factor need to be concerned and “property” is in the less important position when students participate in GL activities.

The number of inclusive factors which were allocated to each main factor also supports the same results as the weightings of the main factors, which offers the same sequence of these four main factors to these two environments. This result demonstrates the sequence of the four main factors is real too. Meanwhile, the influencing factors of GL were carried out through content analysis from the literature, which illustrate the degree of each main factor having been mentioned in it.

The data of this study were collected from Chinese higher education institutions and the results reflect the application of GL in these two environments in Chinese context, which may be not commonly used in other context. Our further study addressed how to use these differences to organise GL in these two environments (the blended e-learning environments).

The weighting sequences of the four main factors represent the differences of GL in these two environments, but they may be not only one sequence to them. In fact, some other methods may also be identified and used in ranking these four factors and to build the new sequences, which may reveal other way to express their relationship. Therefore, the finding of this study, at least, demonstrates that the differences of GL can be identified and was used to guide and examine a GL process in these two environments.

A Framework of a GL Process

The sequence of the four main factors (i.e. processing, engaging, socialising, and property) represents the characteristics of a GL process in the classroom-based and the web-based environments. Their relationship of these four main factors is interdependent and presents the essential stages of a GL process, because they were extracted from the influencing factors. The four main factors and their inclusive variables are related to a GL process and the relationship between them indicates the mechanism, which are working together for maintaining an ongoing GL. A framework is used to describe the relationship of these four main factors and is presented in Figure 1.

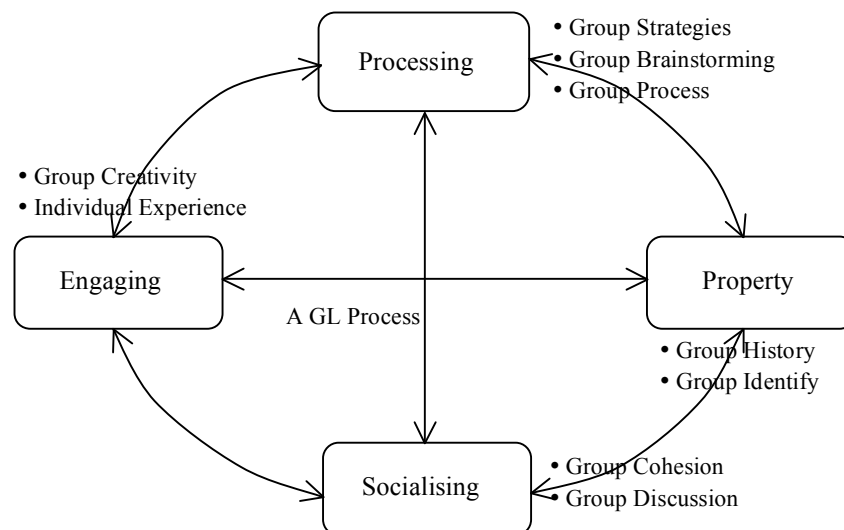


Figure 1 a framework of a GL process

The four main factors of a GL process are dependent on each other wherever in the classroom-based or the web-based environments. The common sub-factors allocated in each main factor are involved in this framework, which were extracted from factor analysis for the two environments.

According to the weightings of the main factors, “processing” in the classroom-based environment is the most important factor comparing with others and “socialising” is the second important factor. GL organisers (e.g.

teachers) should facilitate the group participants to improve their cohesion and communication. "Processing" in the web-based environment is still the most important factor. However, "engaging" becomes the second most important factor instead of "socialising", which organiser (e.g. tutor) should facilitate students to engage in the GL process. "Property" represents group or individual identity and history, which can be used to improve group or individual motivation, and to facilitate group cohesion.

This framework can be considered as a theoretical framework to analyse a GL process in a blended e-learning environments in Chinese higher education field. Wherever it is in the classroom-based or the web-based environments, this framework offers a foundation to simulate the relevant models of GL and KB. Our further studies based on this framework and utilising the GL process and knowledge building model in a blended e-learning environment, and examined the relevant issues about students' attitudes to GL and knowledge building, the effectiveness of GL, and online discussion of group knowledge building through action research in a Chinese higher education institution (South China Normal University, SCNU). The detailed information about this research will be given in our other papers.

CONCLUSIONS

This paper introduced an examination of the difference of GL in the classroom-based and the web-based environments through analysing the influencing factors of a GL process. A questionnaire was designed according to these influencing factors for teachers and the purposes are to examine whether there are differences of these influencing factors of GL and what the differences are in the classroom-based and the web-based environments.

The data were analysed through factor analysis and the results demonstrate that a GL process is different wherever in the classroom-based and the web-based environments through the weightings of the four main factors and the numbers of the sub-factors allocated to each main factor.

It is difficult to express what the differences are because the different methods may cause the different sequences of these four main factors. However, the differences of a GL process in these two environments identified in this study would be useful to utilise in the educational practical field in Chinese higher education. The conclusions from this study are carried out:

A GL process in the different environments will be different in terms of the sequences of the four main factors. The different strategies, organising and evaluation methods for them would be necessary to develop according to the specific differences of GL. The four main factors are interdependent each other, and a framework is developed for describing their relationship, which can be used to analyse and design and simulate a GL process in the classroom-based, the web-based, or the blended e-learning settings. The results of this study will be used in our further research on the relevant issues of GL, such as students' attitudes of GL and knowledge building, the effectiveness of GL, and online discussion of group knowledge building.

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APPENDIX I

I. The results of KMO and Bartlett's test and the screen plot for the classroom-based environments

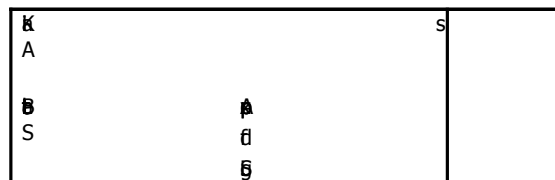


Figure 1.1 the results of KMO and Bartlett's test

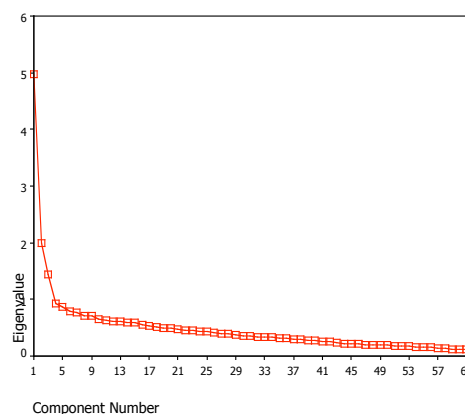


Figure 1.2 screen plot

II. The results of KMO and Bartlett's test and the screen plot for the web-based environments

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.712
Bartlett's Test of Sphericity	Approx. Chi-Square	4310.576
	df	1891
	Sig.	.000

Figure 2.1 the results of KMO and Bartlett's test

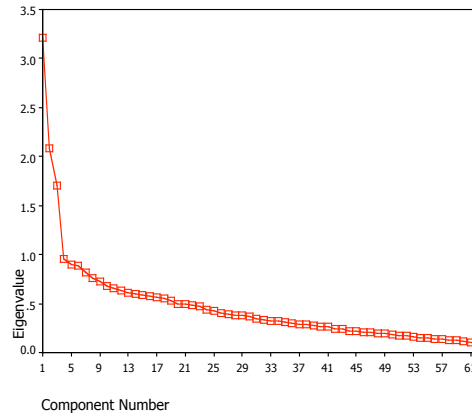


Figure 2.2 screen plot