

A correlative research on the relationship between awareness in collaborative learning and its impact on academic performance

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Abstract. In the collaborative learning environment, the learners will produce certain awareness within the group based on all kinds of relevant information, that is, collaborative-learning awareness. Through survey method, the research tries to understand the status quo of collaborative-learning awareness and to explore the structural components of collaborative-learning awareness and the relationship between collaborative-learning awareness and academic performance. Research shows that: collaborative-learning awareness is divided into four categories: social awareness, task awareness, concept awareness and workspace awareness. Among the four categories, task awareness exerts a direct impact on academic performance; the other three categories, i.e. social awareness, concept awareness and workspace awareness impact on academic performance through task awareness. The research conclusion has certain guiding significance for evaluation of the status of collaborative learning, improvement of learning effectiveness, as well as elevation of collaborative learning awareness.

Keyword: Collaborative Learning, Awareness, The Awareness in Collaborative Learning

1 Introduction

In recent years, the collaborative learning model is gradually popularized and spread under the drive of the increasingly developing theory study. Many teaching and learning activities, including distance education are organized considerably based on collaborative learning model in order to train students' teamwork and collaboration capabilities[1] As a new mode of teaching, what are the other changes concerning psychological characteristics in addition to the change of collaborative learners' studying behavior? How will these changes affect the learner's cognitive process, and what roles will they play in the future learning activities in their academic performances? In the literature research, however, we have not obtained any such literature as collaborative learning awareness, particularly in the aspect of how the learners' social awareness impacts on the learners' learning activities after a full literature search worldwide. This study explores each learner's psychological characteristics and awarenesses and their impact on this learner's academic performance in the collaborative learning activities through awareness theory.

1.1 What are the changes collaborative learning has made by the learners

Collaborative Learning(CL)is what that's all about-learners working together as a group to accomplish shared goals and maximize the learning of each individual by an incentive scheme [2]. At present, computer-supported (networks) collaborative learning CSCL indeed has a prominent role (the collaborative learning discussed in this article mainly aims at CSCL) to play in changing the behavior and acquisition results of individual students, as well as group collaboration performance[3]. For example: extension of time and space has broken through all kinds of separation barriers so that learning has been developed into social learning which is no longer bound by time. Computer and network systems have provided learners not only a wealth of learning resources, but also improvement of learning efficiency [4]. Collective knowledge and wisdom have been given full play to the extreme, and individual learning achievement and collective learning effectiveness have both been upgraded[5]][6] Individual's learning behavior is no

longer regarded his/her own behavior because he/she gradually becomes aware of: (1) His/her individual role and function when interacting with the surrounding environment; (2) common goal and his/her own individual goal in collaboration with other members; (3) his/her individual knowledge structure related to overall knowledge structure; and (4) his/her individual activities related to those of other collaborative members. These changes above will affect the learner's future collaborative learning awareness, values and codes of conduct[7]. And more than those, it will internalize into learners' psychological activities.

1.2 Awareness theory and research done in the aspect of collaborative learning

Awareness is the cognition of a certain fact [8]. And the word "awareness" is also translated into "perception" by some scholars. Awareness is the first step to understand the surrounding environment, also the beginning of all behavioral expressions, which is an important indicator to guide an individual's behavior. In the field of psychology, awareness is a psychological characteristic to distinguish and measure different psychological states[9]. In the field of computer application, awareness mainly focuses on the research of awareness modeling in network virtual environment through appropriate technologies, e.g. agent technology to support the practical application of awareness model [10]. However, learner's awareness is the target of research in collaborative learning aspect, mainly focusing on the application of collaborative learning, known as "collaborative learning awareness", which refers to awareness situation of all the key elements involved in collaborative learning based on the members of the collaborative group.

Goldman (1992) brought forward learners' three awarenesses: social awareness, task awareness and concept awareness [11]. On this basis, Gutwin (1995) also proposed a "workspace awareness" [12] which believes that in collaborative learning, group peers must have four awareness elements: social awareness, task awareness, concept awareness and workspace awareness. And he also presented students' awareness framework as in Table 1.

Table 1. Type list of learners' awareness

Types of awareness	Connotation
Social awareness	What should I expect from the other members of the group? How can I communicate with the group, influence one another? What role will I play in the group? What roles will other members of the group undertake?
Task awareness	How much do I know about the task's theme and structure? How much do I know about the other people's task-based theme and structure? What are the steps need to complete the tasks? How to evaluate the result of the task? What are the tools and resources needed to complete the task? How much time needed to complete the task? How much time available?
Concept awareness	How is the task related to the existing concept? What knowledge do I also need to find out from the theme? Do I need to change my existing concept in the light of new information? Can I pose a hypothesis in order to forecast the outcome of the task based on the existing knowledge?
Workspace awareness	What are the other members of the group doing in order to complete the task? Where are they? What are they doing? What have they completed? What are they going to do for the next step? How can I help with the other members for the completion of their task?

Gutwin's framework of the four collaborative learning awarenesses can be interpreted as:

Social awareness refers to the learner's cognition to the social relations within the group;

Task awareness refers to the learner's cognition to learning task;

Concept awareness refers to the learner's cognition to the existed knowledge and the knowledge required for completion of the task;

Workspace awareness refers to the learner's cognition to the work space and the activities with his/her companions. Work space mainly indicates the collaborative learning environments, including space environment, hardware environment, resource environment, and so on.

The features of collaborative learning awareness include: (1) Collaborative learning awareness is the beginning of learning behavior, and is produced in the process of collaborative learning; (2) collaborative learning awareness guides and influences the learner's learning behavior in the group; (3) since it is the learner's cognition to a variety of dynamic information in the collaborative environment, the collaborative learning awareness is varied according to the changes of environment.

Goldman and Gutwin in their perception theory concerning collaborative learning activities reveals the learners' awareness characteristics as follows: (1) the initiation of learning behavior; (2) outcome in the process of collaborative; (3) to guide and influence the behavioral expression of the learners in the group (4) the cognition of learners' various dynamic information in the collaborative environment; and (5) to change with the changes of the environment. Accordingly, the main concern toward collaborative learning research has shifted from the external learning subject to the internal learning subject, from activity environment and activity forms to cognitive psychology of learners. The theory, however, only needs evidences to be supported by a large number of quantitative studies.

2 Research methods and tools

The research adopts questionnaire method, and uses the data collected as the basis for quantitative research.

2.1 Questionnaire preparation and selection of subjects

On the basis of literature investigation, the questionnaire prepared oriented for the research of collaborative learning awareness utilizes Gutwin's learner's awareness framework as the basis. The questionnaire is established for the following four

dimensions: social awareness, task awareness, concept awareness and workspace awareness.

Social awareness

The contents of the dimension include:

- ◆ What is the role the learner playing in his/her own group? and what are the roles the other learners playing in the peer group in the process of completing the task in a collaborative way?
- ◆ How to communicate with group peers?
- ◆ Whether he/she is clear about what will be learned from other peers of the same group? etc.

Task awareness

- ◆ The contents of the dimension include:
- ◆ What are the theme and structure of the task?
- ◆ How to evaluate the result of the task?
- ◆ How to complete the task?
- ◆ How long does it take to complete the task? And when is the final deadline for the completion of the task?

Concept awareness

- ◆ The contents of the dimension include:
- ◆ What are the knowledge involved in the theme?
- ◆ What are the knowledge do I have?
- ◆ Which problems can an individual solve by using his/her original knowledge?
- ◆ What other new knowledge needs to be supplemented in order to solve a particular problem?
- ◆ What knowledge have I acquired when participating in the completion of activities or tasks? etc.

Workspace awareness

- ◆ The contents of the dimension include:
- ◆ What are the other group peers are doing at a particular stage?
- ◆ What are the views and attitude on a particular issue?
- ◆ How the other group peers are getting along with their learning? (What have been completed and what to do next?)
- ◆ What difficulties are the other peers going through in their learning?
- ◆ How to provide assistance to the other peers? etc.

See table 4 for specific connotations on four categories of learner’s collaborative learning awareness.

Table 2. The dimensions and connotations of the questionnaire concerning collaborative learning awareness

Dimension of awareness	Connotation of awareness	Specific contents of awareness
Social awareness	The understanding of social relations within the group	The role played, and function exerted Exchanges and communication Group interaction
Task awareness	The learner’s understanding of the group task	The theme and structure of the task Concrete requirements of the task The necessary preparation for the task to be completed Temporal-planning for completion of the task
Concept awareness	Learner’s understanding of the existed knowledge and the knowledge required by the task	The new knowledge involved in completion of the task The relationship between the existed knowledge and the solution of the task The link between new knowledges
Workspace awareness	The learner’s understanding of the latest activities of the group peers	Views and attitude of the group peers Peer learning progress The impact of the group peers The expected results whose responsibility is assumed by the other peers

The questionnaire adopts the most commonly used Five-point Likert Scale educational research. Except reverse design problem, the expression of problems in the questionnaire all represents a learner’s collaborative learning awareness in a certain aspect in the positive sense. After reverse solution, it shows that the higher the scores of each problem, the higher the level of awareness of the learner’s appropriate problem. The questionnaire is classified into two sections: self-evaluation and mutual evaluation among the group peers. Finally calculate the weighted average value based on scores of the subjective and objective evaluations.

The research is based on the subjects who are currently carrying out collaborative learning activities in the way of random sampling, that is, selecting regular undergraduates and graduate students with the exception of overseas students in the Beijing Normal University. Distribution of subjects' grades ranges from the first-year grade to the third year grade, as well as from first-year graduate students to second-year graduate students. The research also covers different academic courses, that is, liberal arts and science courses, for example, "Multi-media Technology and Web Page Making", "Basic Computer Application Course", "Curriculum Development", and so on. 129 subjects in the 33 collaborative study groups participated in survey. Finally, among the 122 questionnaires to be collected, 117 are valid questionnaires—the collecting rate is 94.6%, and the effective rate is 98.3%. Among the 117 subjects, 93 are undergraduates, accounting for 79.5%; 24 are graduate students, accounting for 20.5%; 35 are male students, accounting for 29.9%; 82 are female students, accounting for 70.1%. Most of the subjects usually prefer to independent learning, accounting for 71.6%; and the subjects who prefer to collaborative learning, however, only accounting for 28.4%.

2.2 Analysis of validity and reliability of the questionnaire data

The research uses Amos software, adopts confirmatory factor analysis method to implement structural validity analysis. The level of structural validity is reflected through the fitting degree of between data and theoretic hypothesis model. The theoretical model of collaborative learning awareness questionnaire includes four major dimensions (19-items).

Table 3. The fitting optimization indexes of model validation

Fitting indicators	X ²	P	X ² /df	NFI	IFI	TLI	CFI	RMSEA
Values	183.562	.019	1.257	.946	.989	.985	.988	.070

The indexes reflect that this model fits well in various indexes and show the questionnaire has fine structural validity. In a word, based upon literature investigation and study in statistical analysis, this study complete the awareness dimensions of learners in collaborative learning. Besides, it has also adjusted the structure of questionnaire after program distinguishing degree analysis.

By Using SPSS for truth test of questionnaire, the data internal consistency coefficient (Cronbach α) reflects that the reliabilities of four dimensions in collaborative learning awareness questionnaire -- conceptual awareness, task awareness, social awareness and workspace awareness as well as total scale are all

above .6. It proves that data has good internal consistency.

Table.4. α - coefficients in dimensions and total scale

Total Scale	conceptual awareness	task awareness	social awareness	workspace awareness
.9031	.6289	.6833	.7309	.7304

3 Research Process

3.1 Relationship between learners’ awareness and academic achievement in collaborative learning

The relationship between four dimensions of awareness and academic achievement in collaborative learning is planned to use correlation analysis to study the relationship of scores of conceptual awareness, task awareness, social awareness and workspace awareness and academic achievement. Considering the differences of teaching content and test difficulties in different classes, academic achievements are all represent by Z scores.

Table 5. The average awareness level based on the learners’ self-assessment in collaborative learning

	N	Minimum value	Maximum value	Average score	Standard deviation
Concept awareness	117	1.75	4.75	3.40	.58
Task awareness	117	1.83	4.67	3.53	.51
Social awareness	117	1.25	5.00	3.49	.62
Workspace awareness	117	1.60	4.80	3.42	.60

Note: The full score of each average awareness dimension is 5 points.

Result of correlation analysis shows that, there is significant positive correlation relationship between Z scores of learners' academic achievements and learners’ scores on conceptual awareness, task awareness, and workspace awareness. Detailed correlation coefficients are shown in Table 1. Therefore, we can conclude that academic achievements of learners in collaborative learning are close related

with scores of conceptual awareness, task awareness and workspace awareness, showing consistent trend.

Table 6. Correlation analysis on learners’ awareness level and academic achievement

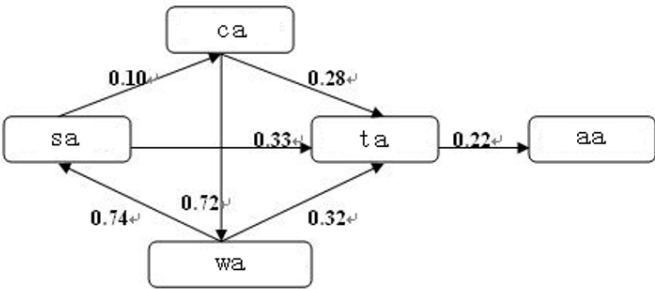
		sca	sta	ssa	swa
aa	Pearson Correlation	.218*	.232*	.164	.237*
	Sig. (2-tailed)	.018	.013	.078	.011
	N	117	114	116	113

*.Correlation is significant at the 0.05 level(2-tailed).

Remarks:
aa: academic achievement
sca: score of concept awareness
sta: score of task awareness
ssa: score of social awareness
swa: score of workspace awareness

3.2 Path analysis on learners’ awareness in collaborative learning and academic achievement

In the above correlation analysis, it shows that social awareness has no significant correlation with academic achievement. In order to further ascertain the relationships and interactions of different awareness and academic achievement, use Amos 4.0 to establish mutual paths. See Figure 1.



Remarks:
ca: concept awareness
sa: social awareness
ta: task awareness
wa: workspace awareness
aa: academic achievement

Figure.1. Path analysis on learners’ awareness and academic achievement
In Figure 1, predictive values and directions show that in the influence that

learners’ collaborative learning awareness exerts to academic achievement, task awareness is a direct variable, which has direct impact on academic achievement. While other awareness all exerts the influence directly through task awareness, predictive values measuring three influences are respectively $0.5104\left(0.72 \times 0.32+0.28\right)$, $0.358\left(0.10 \times 0.28+0.33\right)$, $0.3407\left(0.74 \times 0.10 \times 0.28+0.32\right)$. We can conclude that, the impact of conceptual awareness, social awareness and workspace awareness to academic achievement are functioned through task awareness, indirectly.

3.3 Analysis on the influence of task awareness to academic achievement

According to the above path analysis, it is shown that task awareness can directly affect academic achievement. Here we adopt variance analysis to discuss the significance of the impact that task awareness exert to academic achievement and the mathematic model of the two factors.

Let task awareness be independent variable and academic achievement be dependent variable. The variance analysis in Table 7 shows that: task awareness has significant impact on academic achievement. $\text{Sig}=.040<.05$.

Table.7. Variance analysis on the impact of task awareness on academic achievement

	df	Mean square	F	sig
Between Groups	89	74.833	1.884	.040
Whin Group	24	39.711		

Remarks:
aa: academic achievement
..

Next, let task awareness be independent variable and academic achievement be dependent variable. Use regression analysis to establish mathematical model and we can obtain the following results. See Table 8:

Table 8. Regression analysis on the impact of task awareness to academic achievement

Model	B	Std.Error	Beta	t	sig.
1 (constant)	78.592	2.209	.237	35.576	.000
gpta	2.651	1.044		2.540	.012

Remarks:
gpta: group placement of task awareness
aa: academic achievement

..The mathematical model is:

$$\text{academic achievement} = 78.592 + 2.651 * \text{task awareness}$$

4 Research Conclusions and Suggestions

By investigating awareness of learners in collaborative learning, we obtain the following main conclusions:

Correlation relationship of on learners' awareness level and academic achievement shows that, learners' conceptual awareness, workspace awareness and task awareness all have positive correlation relationship with academic achievement. Path analysis of learners' awareness in collaborative learning and academic achievement demonstrates that, task awareness directly exerts on academic achievement, while other three awareness affect academic achievement indirectly through task awareness. And impact of task awareness to academic achievement is significant. The regression analysis reveals the mathematical relationship between the two.

This study is confined to a comparative study of collaborative learning activities without diverse cultural backgrounds from the East and the West. Consequently, differences of collaborative learning awareness levels under the background of different cultures of the East and the West cannot be really discovered. However, from the statistical data that 71.6% of the subjects preferred to independent study, the collaborative learning awareness level of Chinese learners is relatively low level. Based on the conclusion of the research, several suggestions are put forward regarding collaborative learning.

4.1 Collaborative learning awareness is reasonable index to assess collaborative learning situation

Collaborative learning awareness is a psychological feature which functions on collaborative learning in different degrees. In this sense, awareness level is also an important index in collaborative learning assessment. It can help to allocate different characters within groups according to different awareness levels of learner. Besides, it also provides basis for heterogeneous combination.

4.2 Increase of task awareness is the key point to effects of collaborative learning

Since task awareness is the most direct key factor affecting academic achievement, teaching organizers should focus on reasonable design of teaching activities in different stages of collaborative learning. For example, objective-oriented teaching strategy helps to raise different awareness level of learner. Besides, increase of task awareness level is one of the most effective strategies to raise efficiency of collaborative learning.

4.3 Cultivation of conceptual awareness, social awareness and workspace awareness is of the same importance.

Since conceptual awareness, social awareness and workspace awareness affect academic achievement in collaborative learning indirectly through task awareness, the influence cannot be overlooked. Especially, social awareness and workspace awareness are the important factors of group interpersonal relationship. Students higher in social awareness level are generally suit for leader or coordinator characters, which may help the group face study task easily, and at the same time, he or she is also good at coordinating relationships of group peers and promoting task awareness level of other group peers.

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