

## Vocational students in Thailand: collaborative learning via the Internet in groups of different sizes

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**ABSTRACT:** The effectiveness of collaboration in groups of different sizes and how students collaborate within each group were studied. The participants consisted of first year Diploma in Vocational Education students from two institutes in Thailand. The Web-based modules on digital technique were undertaken by groups of three, four and five members, 92 students in total. The ANOVA results showed that the group of three students earned the highest scores as compared to the other groups with different group sizes. The mean scores of the group of five students were the lowest scores and varied more than the other groups of different sizes. The results for collaboration in the groups of three students showed more academic and social communication than for other group sizes.

**Keywords:** Group sizes, co-operative learning, on-line learning/digital technique, vocational students

### INTRODUCTION

Vocational curricula are designed for specific career objectives and, therefore, experience-based performance is emphasised. Students have to practise and gain practical experience in order to apply their skills in the real workplace. Schools must prepare educational programmes/methods of technical education that provide not only job skills but also thinking skills and opportunities for the highest order of collaborative work. To succeed in learning, students should be provided with suitable facilities and a suitable environment, and also suitable management tools, such as multimedia, job sheets, textbooks.

#### Collaborative Learning

Collaboration is one strategy to promote learning and the need to be well-managed. An effective process of collaborative learning could be implemented for tasks in the classroom and on the Web. Collaborative interaction on the Web is asynchronous through e-mails, chat or a Web site and shows the relationship among participants.

According to Shawn, collaboration could be on three levels viz. team, community and network collaboration. Basically, collaborative learning in class occurs after exact goals are set. Learners collaborate with one another for achieving their common goals. Instructors should design and manage appropriate activities for the learners to enhance collaboration in each team. Such activities include: problem setting for discussion or finding a solution; co-operative tasks (through reports, projects, performance using some skills); exercises or even tests [1].

#### Learning on the Web

Efficient management of Web-based learning is powerful, not only for learning but also for sharing knowledge among learners, which, in turn, supports learners to gain knowledge. Instructors should also concern themselves with stimulating the creation of effective e-learning environments, which include learning resources, learning support, activities and determining appropriate group sizes. Oliver suggests three critical elements of on-line learning designed to promote co-operative learning, i.e. learning design as a learning task, learning resources and learning support [2]. To manage collaboration on the Web, instructors ought to determine and design elements such as setting targets, the design of systems and models of collaboration.

Web-based collaborative learning has become a popular learning approach in education. Collaborative learning on the Web requires a different management and has a different impact from collaboration in the classroom. Zhao and Kanji studied Web-based collaborative learning strategies and pointed out that Web-based collaborative learning could be integrated with the traditional classroom learning process [3].

### Group Sizes

Group size is an important factor in promoting learning. Small groups might be effective but they are more expensive. Co-operative groups let students share and organise their thoughts. Group communication on the Web is different from communication in an ordinary class because the latter communication must occur on a fixed schedule, whereas Web-based communication can take place anytime when learners feel free to learn.

The effectiveness of group members depends on task types and purposes. In ordinary classes, large groups are better for discussions where members are exploring and collecting information. However, learners in large groups may have no chance to share their ideas or they might be dominated by other group members. However, groups must be large enough to ensure diversity [4]. In some tasks a greater group size might be of benefit, if the group could be managed in respect of the impact on performance and the benefits of collaboration. A suitable group size will support students in mastering their knowledge and also to effectively manage the curriculum.

Gorsky and Chajut studied how discussion was affected by group size in distance learning. It was found that the proportion of learner-learner interactions increased as group size increased, while the proportion of instructor messages decreases [5]. In the case of learning modules on the Web, large groups may face problems with communication given learners' varied skills in using technologies and the systems and facilities provided for communication. If instructors allow enough time, they have the possibility of adequate communication. If learners do not have to do much work on the Web, and it is not necessary to communicate with or share ideas in large groups, small groups might be more convenient. Moreover, the characteristics of group members are another important component of group working [6].

Some group members may prefer to use e-mails or Web boards because they have better skills in these technologies, but other members of the same group may have less skill in such technologies. Thus, these may fail to respond to group communications. Therefore, instructors have to assign activities suitable to all members concerned. Instructors have to guide, follow up and provide their students with appropriate facilities. For classroom learning, students are normally assigned to a four-member learning team. In the context of learning on the Web, group size is an important factor that requires investigation to determine the impact on group interaction. Interaction patterns and learning benefits are affected, if there are two members or between three and six members, especially, if equal participation or collaborative products are to be produced [7]. Small groups generally mean greater member involvement, but they may not have sufficient resources and the ability to engage in discussion of every potential solution [8].

As a group becomes larger, the emotional identification and sense of deeply shared commitment becomes more difficult to establish and maintain; therefore, members in larger groups are less satisfied [9]. As group size increases, the efforts of individuals seem to decline. However, groups must be large enough to ensure diversity [4]. The studies of synchronous collaborative activities through modules on the Web usually involve two partners. If a greater group size could be managed in its impact on performance and collaboration, it might be beneficial to design activities.

### OBJECTIVES

To explore students' collaborative learning on a Web module, in groups of different sizes, was the objective of this study.

### PROCEDURE

Model used for learning design: Web-based instruction (WBI) modules for learning on digital technique combined with collaboration were developed for three dimensions: analysis, design, and systems for learning; then, the collaboration model was set. There were three dimensions for the collaboration: 1) For each unit to do an assignment together; 2) To collaborate in a team by asking questions and receiving answers from other members using a Web board; and 3) To discuss the questions/problems in real time and to send the e-mails to each other within the team.

Computer network and other facilities were created to support the system. Students were also trained to use the network. They were designed to be groups of three, four or five. Each group was assigned tasks and exercises on the network. Internet protocol addresses for each specific group were set to check the student records. Each member of the group had to log in a fixed number of times.

The sample was 92 vocational students from two institutes in Thailand, who studied in the field of Electronics, Electronics Communication and Computer Techniques. They were divided into three, four and five members per group. Each group consisted of students of various abilities.

The tools were: 1) Web-based instruction modules on digital technique; 2) Test; and 3) Questionnaire. These tools were developed and assessed by experts on content validity and, also tested for improvement before the real experiment.

Data collection: WBI on digital technique was applied on the Web. Each group agreed to work together to complete their tasks in time. For learning activities, students had to share their knowledge through questions and answers, search for more information and do the exercises. They also had to utilise the Web board, chat room, and e-mails to their team members and instructors. Tests were conducted before and after the experiment.

## RESULTS

Effects on achievement: Mean and standard deviations by group and the pre-test and post-test scores for groups of three, four and five members are shown in Table 1.

Table 1: Mean scores and standard deviation on post-test scores of each group size.

Group Size												Total	
		1	2	3	4	5	6	7	8	9	10	Pre-test	Post-test
3	$\bar{X}$	33.67	32.33	31.33	34.00	35.00	32.00	33.00	32.33	30.00	30.67	13.10	32.43
	SD	1.15	1.53	1.53	1.00	1.00	2.00	1.73	1.53	1.00	2.52	2.01	1.98
4	$\bar{X}$	32.50	31.75	33.50	32.25	31.71	33.00	33.25	28.75			16.03	32.09
	SD	2.38	0.50	1.29	1.26	0.50	2.71	1.71	2.99			3.39	2.19
5	$\bar{X}$	28.40	28.20	29.60	29.60	30.20	29.20					13.60	29.03
	SD	2.97	3.19	3.36	3.36	1.30	2.39					2.13	2.68

The mean scores of groups of three members were significantly different from groups of four or five members. However, there was no significant difference between groups of four and five members. Groups of three had more, but less varied scores than the two other group sizes. Their standard deviation ranged from 1.00 to 2.52. They obtained the highest mean earned scores. Groups of five obtained the lowest post-test score. The highest score for groups of five members was 30.20, and the lowest was 28.20. The standard deviation varied more than the other two group sizes (SD between 1.3 and 3.36). Groups of four obtained moderate post-test mean scores; however, their standard deviation was quite varied (0.50 to 2.99).

### The Study of Students' Collaboration in Groups

Students were asked to report how they contacted one another in two aspects; communication on the Web and social communication (without their names in the reports). They were observed by the researchers' assistants in order to check their reports. The data on collaboration by each group were analysed. The amount of collaborative learning inside groups of three, four and five members was compared.

Table 2: Percentage among groups of collaborative learning on the Web.

Frequency	More than once a week (%)			Once a week (%)			Less than once a week (%)		
	3	4	5	3	4	5	3	4	5
Item/Group sizes									
Communication on Web									
1. Exercise	46.67	28.13	13.33	40.00	53.13	60.00	13.33	18.75	26.67
2. Assignment	60.00	46.88	26.67	33.33	40.63	46.67	6.67	12.50	26.67
3. Question and answer on white board	43.33	28.13	23.33	43.33	56.25	56.67	13.33	15.63	20.00
4. Chat about lessons	60.00	43.75	20.00	33.33	40.63	66.67	6.67	15.63	13.33
5. Email	53.33	25.00	13.33	23.33	34.38	20.00	23.73	40.63	66.67
Communication outside Web									
6. Discussion about learning problems	46.67	21.88	10.00	40.00	50.00	33.33	13.33	28.13	56.67
7. Discussion about other problems	16.67	6.25	6.67	40.00	18.75	13.33	43.33	75.01	80
8. Chat about general topics	50.00	40.63	23.33	40.00	46.88	40.00	10	12.94	36.67
9. Other communications with other members	23.33	9.37	6.67	30.00	15.63	6.67	46.66	68.75	86.66
10. Help members in general tasks	23.33	15.63	13.33	53.33	34.38	20.00	20	50	66.66

The communication/collaboration was recorded as *more than once a week* for a learning unit, *once a week*, and *less than once a week*. As a whole, students collaborated with other group members, both in academic and social aspects. The percentage of their collaboration in all items for groups of three was quite good at *more than once a week*, except for discussions about other problems.

The behaviour of groups of different sizes was determined in order to find out the collaborative efficiency for each group size. Group sizes of five showed the least collaboration in many aspects. The results in percentage terms are shown in Table 2.

From Table 2, the percentages of collaboration on the Web (more than once a week) are shown in Figure 1 and outside the Web in Figure 2.

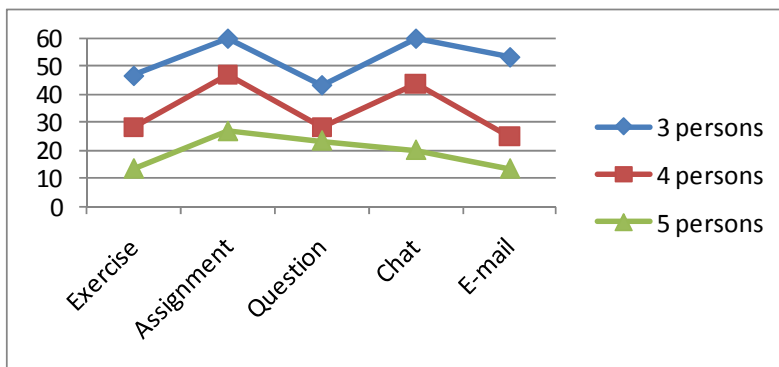


Figure 1: Collaborative learning on the Web: more than once a week.

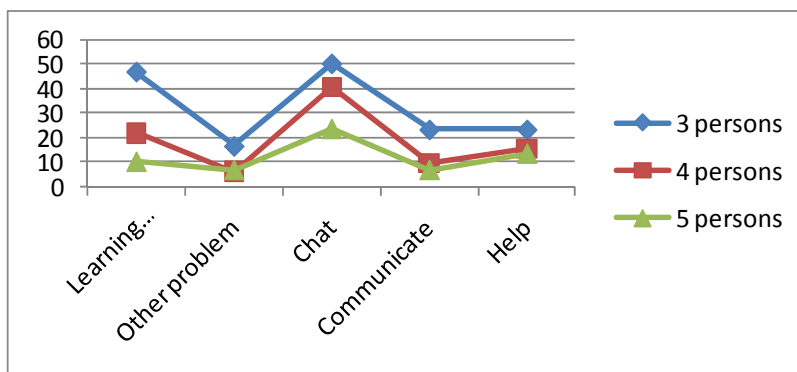


Figure 2: Collaborative learning outside the Web: more than once a week.

Figure 1 shows the percentages for collaborative learning on the Web in groups of three, four and five members, and includes exercises, assignments, questions and answers on the Web board, chats about lessons and e-mails about lessons. The percentage of collaboration in groups of three members *more than once a week* was the highest for all items. The collaborative percentage for groups of four members was higher (four in five items; except for e-mails) than for groups of five members.

Figure 2 shows the collaborative learning outside the Web (social aspects) in groups of three, four and five members for *more than once a week*, and includes discussions about learning problems and other problems, chats about general topics, other communications and helping members in general tasks. The collaborative percentage for groups of three was the highest for almost all items.

Group assistants were asked to assess group activities and their records supported the above results. It was also consistent with learners' reports. In studying digital technique, groups of small size showed more collaboration and communications in academic and social aspects than the other groups of larger size. The students were asked to evaluate the learning in ten aspects. Means and standard deviations of groups were compared by group sizes, as shown in Table 3.

Table 3 shows that, on the whole, students' evaluation of learning digital technique on the Web was quite good, especially for the item of *feel free to learn*. The mean scores of students' opinions for groups of three members were higher than the two other group sizes in all items ( $\bar{X}$  =4.90 to 3.63). The mean scores of groups of five members were the lowest in every aspect ( $\bar{X}$  =4.50 to 2.07).

Table 3: Mean score and standard deviation of students' opinions toward learning on the Web, by group size.

Item	3 persons		4 persons		5 persons	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
1. Convenience to accessibility	4.73	0.45	4.19	0.64	3.6	0.76
2. Suitable time to learn	4.53	0.68	4.41	0.71	4.50	0.68
3. Method of learning on Web	3.73	0.94	3.75	0.80	3.47	0.97
4. Supplementary exercises	4.17	0.83	3.63	0.96	2.93	0.78
5. Knowledge from learning units	4.33	0.48	4.00	0.51	3.57	0.50
6. Feel free to learn	4.90	0.40	4.53	0.72	4.40	0.67
7. Equipment support learning on Web	4.70	0.53	4.16	0.81	3.83	1.02
8. Convenient to use e-mail	4.33	0.66	3.66	0.97	3.13	0.90
9. Time spent for self learning	3.97	0.93	2.91	1.09	2.50	1.17
10. Convenient to use Search Engine	3.63	0.81	3.09	1.20	2.07	1.08

## DISCUSSION

Regarding learning digital technique via the Internet, students in groups of different sizes were able to achieve significantly higher post-test scores. This was consistent with Chanchalor and Powichai, who studied the effect of distance learning via the Internet on electric motor control and found that students obtained higher scores on the post-test than the pre-test [10]. This finding confirmed that learning on the Web was helpful and, as effective as traditional classroom learning; researchers applied instructional design theories to Web development, and to determine and analyse strategies. The learning module was designed for collaboration in groups' support learning. Students may learn through the assistance of other group members.

The results can be attributed to several factors. One factor was connected to the innovation of learning on the Internet. Another factor was the design of this multimedia technology, which attracted the attention of technical and teenage students. This multimedia technology could help students and be an alternative to providing pages of plain text.

According to the results, the most effective group size for collaborative learning on the Web for this course was three. Fisher et al mentions that group size has a significant impact on group success [11]. Groups of three members were able to acquire knowledge easily and consume less material or equipment than groups of two. Groups of five learners achieved the lowest scores, as Ditzza et al investigated the effects of two context variables on small group learning (group sizes of three, four and five members), and found that groups of three members elicited more integrated and general learning behaviour, while groups of five members elicited more co-operative learning behaviour, listening and social interaction [12].

With collaborative behaviour, small groups had a better chance to communicate, as Lowry et al and Chen et al found in their studies on the impact of varying group size and social presence on small group communication [13][14]. The smaller groups established and maintained a higher level and quality of communications. Groups with the combination of face-to-face and computer-mediated communication had higher levels of quality communication than other groups using only computer-mediated communications.

The percentage of communication (exercises, assignments, questions on Web board, chats and e-mails.) for all group members was quite high. This was a result of the module design requiring collaborative working, and system management. Wagner et al studied the effects of group size on problem-solving and suggested that groups of three to five people performed better than individuals when solving complex problems [15]. In this study, the interaction of groups of three was more frequent in all aspects than any other group size. The group members of three were closer and felt freer to communicate and could better interact and exchange knowledge on Web-based learning. Thus, their scores did not vary much. This group size might have been suitable for collaborative learning and the module system of WBI for digital technique.

## CONCLUSIONS

Lave and Wenger mention that learning performance is strongly affected by peers [16]. Larger groups may have less convenient communication through the Web. The evidence from this study which confirmed this, was that the mean scores on the post-tests for three-member groups were higher but less varied than for groups of four or five (Table 3). The mean scores of groups of four and five showed no significant difference. Therefore, where there is limited equipment availability, groups of five members, instead of four, could be managed in learning through Web modules. However, groups of five seem to be poor in enhancing students' behaviour in Web collaboration. Thus, groups of three students showed more satisfaction with learning on the Web, in every item, as compared to any other group size.

It was also noticed that students with good backgrounds or more experience with computers could learn faster than those with less experience. Stein and Calvin state that lack of experience with the technology, frequency of feedback,

language barriers, group size and subject matter impacted students' learning [17]. Thus, students should be trained in this competence and networking system to improve their efficiency and to make learning more convenient.

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## BIOGRAPHIES



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