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Elementary Students' Achievement and Participation Using Three Types of Web-based Feedback

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Abstract

The purpose of the study reported in this paper was to investigate elementary students' achievement and participation when receiving three types of web-based feedback in the context of a project involving collaborative learning. Participants were 108 elementary students in Bangkok, Thailand. Three types of feedback (weekly with scores; weekly with scores and explanations; and feedback every two weeks with scores and explanations) were provided to three clusters of students. Each cluster received one of the three types of feedback. Results revealed that the highest achievement was with students who received weekly scores and explanations. Participation levels were lowest in the group receiving weekly scores only.

Keywords: *Feedback, web-based learning, collaborative learning, elementary school children, participation, achievement.*

Introduction

As stated by Restine (2008), "feedback is a powerful way to shape student learning". It is effective in assisting students with written work (Macdonald 2001). It can be "a motivator for increasing response rates or accuracy" (Kulhavy and Wager 1993; Vasilyeva *et al*. 2007). According to Bischoff (2000), as cited by Vasilyeva *et al*. (2007), "students need regular feedback in order to know how their performance was evaluated, how they can improve, and how their grades are calculated". Studies investigating feedback have involved different aspects and have been conducted in different fields (e.g., Codding *et al*. 2005; Humble *et al*. 1992; Dominick *et al*. 1997; Dyke *et al*. 2008; Lin *et al*. 2001; Ma 2008).

Also, "feedback plays an important role in web-based learning" (Vasilyeva *et al*. 2007). According to Kruse (2004), web-based learning has the advantage that "access is available anytime, anywhere around the globe".

Automatic feedback functions can be implemented when learning using the Web. Mory (2003), as cited by Vasilyeva *et al*. 2007, suggested that "feedback in a web-based learning system" should be "prompt, timely, thorough, constructive, supportive, substantive and consistent". Smits *et al*. (2008) investigated "the effectiveness of different types of feedback content (elaborate versus global) and feedback timing (immediate versus delayed) for learning genetics in a web-based learning environment as a function of learners' prior knowledge. It was hypothesized that learning outcomes of students with low prior knowledge would be fostered by immediate elaborate feedback, whereas those of students with more prior knowledge would be enhanced by delayed global feedback".

Oliver and Omari's (2001) study of "collaborating and learning in a web-based environment" found that "students saw value to be gained from learning" in this environment. However, its limitations include the lack of human contact (Kruse 2004), which may present challenges in terms of feedback.

The review of the literature conducted for this study uncovered few studies that have been conducted in relation to feedback for children at the elementary school level and none on

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elementary students and feedback in web-based, collaborative contexts of learning. The purpose of the study reported in this paper was to investigate the effectiveness of different types of web-based feedback with students at the elementary school level. The study focused on three types of feedback, as follows: weekly with scores; weekly with scores and explanations; and bi-weekly (twice per month) feedback with scores and explanations with three clusters of students. The study's research questions were as follows:

1. Which of the three types of feedback is most effective in terms of achievement?
2. Which of the three types of feedback is most effective in terms of participation?

Review of the Literature on Feedback for Learning

Kulhavy and Wager (1993) found that "feedback reinforces a message to automatically connect responses to prior stimuli". Also, "it provides information that learners can use to validate or change an error response" (Vasilyeva *et al*. 2007). Laister and Kober 2005) stated that "feedback can be given in several forms in the learning process. It can come from the tutor, from peers, or from both". Feedback could be presented in many forms; such as textual, graphical, animated, audio, video, or a combination of these.

Hancock *et al*. (2005) classified feedback into group or individual feedback, whereas Vasilyeva *et al*. (2007) used a variety of parameters such as time of occurrence, progress coverage, target, function, intention, complexity, form of presentation, and grading information. They classified types of feedback, as shown in Table 1.

Dempsey and Wager (1988), as cited by Vasilyeva *et al*. (2007), studied "types of immediate feedback as informative, corrective feedback given to learners as quickly as the system will allow during instruction. Delayed feedback is informative, corrective feedback given to learners after a specified programming delay interval during instruction."

Table 1. Classification of types of feedback. (adapted from Fig. 3 in Vasilyeva *et al*. 2007).

Feedback elements	**Type of feedback**
Time	immediate, delayed, random
Progress coverage	immediate, continuous, and summative
Target	individual and group
Function	confirming, informing, correcting, explaining, evaluating, rewarding, motivating, criticizing, attracting attention
Intention	positive, negative, and neutral
Complexity	knowledge of response, of result, answer until correct, elaborated feedback
Presentation	textual, graphical, animated, and auditory
Grading	formative and summative

Kass and Finin (1987) classified types of feedback into "explicit, implicit, and mixed-mode acquisition feedback". Normally, classification depends on the purpose of study.

Several kinds of feedback have been studied. McGourty *et al*. (2000), as cited by Bitchener *et al*. (2005), "examined the use of multisource assessment and feedback processes in the classroom and the potential impact on student learning". They found that assessment processes that focused on control and goal setting helped students be more proactive. Lee (1997) and Ferris and Roberts (2001), as cited by Bitchener *et al*. (2005), "found a significant effect for the group of students whose errors were underlined compared with the group who received no corrective feedback or only a marginal check".

An increasing number of studies have investigated "whether some types of feedback are more suitable than others" (Bitchener *et al*. 2005).

Oliver and Omari (2001) suggested "an organizing strategy to aid students in the problem-solving process". They found that "adequate feedback" was necessary "to ensure reflection among the learners and to ensure the quality of their solutions".

Bitchener *et al*. (2005) investigated "the effect of different types of corrective feedback (direct, explicit written feedback and student-researcher five-minute individual conferences; direct explicit written feedback only; no corrective feedback)" in a context of 53 adult migrant students writing in English. The said study found "a significant effect for the combination of written and conference feedback on accuracy levels in the use of the past simple tense and the definite article in new pieces of writing but no overall effect on accuracy improvement for feedback types when the three error categories were considered as a single group".

Truscott (1996), as cited by Bitchener *et al*. (2005), reported on "several studies that have not found significant differences across the different treatment groups (content comments; error correction; a combination of content comments and error correction; error identification, but no correction)"; however, he indicated that the study's findings should "be treated with caution". Several studies have investigated which type or what condition of feedback might be suitable for which kind of students. Bitchener *et al*. (2005) also cited a related survey by Ferris and Roberts (2001) which revealed that "students and teachers preferred direct, explicit feedback rather than indirect feedback". Falchikov (1996) "improved learning through peer feedback and reflection for three studies. The first study related to oral presentation skills. Positive feedback was found to be more forthcoming than hints for improvement".

A study by Levine and Schneider (1989) reported on several experiments conducted to "investigate how performance feedback in a computer-based training environment affected students". Two types of feedback were used: "temporal trends in one's own performance and temporal trends in both one's own and others' performance". The results indicated that type of feedback influenced how well students performed. The impact of feedback in both one's own and others' performance was "affected by the amount of practice time needed to achieve proficiency and might have a larger effect with extended training periods representative of normal classroom instruction" (Levine and Schneider 1989).

Methods

Participants

Participants were 108 students in three Grade 6 classes in Bangkok, Thailand. The students were divided into 27 groups with each group consisting of four students who were varied in ability. They completed a collaborative web-based learning project designed for the study. The same teacher served as researcher in all three groups providing one of three types of feedback to each group.

Context

The content of web-based, collaborative learning related to computer information and technology for elementary school students. The learning began with an orientation and introduction, rapport-building, and information about how to learn through collaborative, web-based learning. Next, groups were formed, group leaders selected and discussions held about the project**.** Topics related to the Internet such as the advantages of the Internet; how to use search engines; how to access information; how to use information from the Internet.

Activities

After learning a particular concept, the students completed activities in a group. To complete their activities, they had to use e-mail to find more information from group members and also from the teacher. The teacher set up a chat-room for them to communicate with each other. Once each group completed their activities, they had to send them to the teacher electronically. After all activities were completed at the end of a two-month period, students had to compile all of their activities into an electronic summary of their project and submit it to the teacher. The summary could be in the form of a slideshow or 'e-booklet'.

Feedback

After students completed a web-based activity, they then submitted it electronically as a group to the teacher. Each group received one of three types of feedback from the teacher:

1. Weekly with scores;
2. Weekly with scores and explanations;
3. Bi-weekly feedback with scores and explanations.

Procedures

Pre- and Post- tests

All individual students completed a pre-test prior to the start of activities. The purpose of the pre-test was to assess their prior learning on the content (e.g., prior Internet searching abilities). The format of the pre-test was a multiple choice test with 33 items. The pre-test was administered by the teacher and took approximately half an hour to complete. The teacher created the tests. Students were grouped based on the results of the pre-test in such a way that there was a variety in the groups in terms of the pre-test scores.

All individual students completed a post-test after all the activities. The test was the same as the pre-test. The purpose of the post-test was to assess knowledge gains and achievement. It was administered by the teacher.

After learning the content, the group of students had to do their activity. They then submitted their activity using e-mail. The teacher provided them with group feedback. Nine groups (class one) received Type I feedback, another nine groups (class two) received Type II feedback and another nine groups (class three) received Type III feedback.

Participation was assessed by the teacher and by the group themselves. The teacher observed their behaviour according to five criteria as follows: preparation; completion of assignments; sharing ideas/questions; solving problems; communicating with teacher. The scale was: always; sometimes, never. Groups also completed a self-report on their participation after the second and the sixth weeks using the same rating scale.

Data analysis

Data analysis involved descriptive statistics (e.g., mean and standard deviation), *t*-test and *F*-test used for the results of achievement and to test group differences. Frequency was used for the participation data which was aggregated to include the teacher's with the group's self-rating.

Results

Research Question 1: Which of the three types of feedback was most effective in terms of achievement?

Comparisons were made with regard to achievement of student groups by type of feedback. Mean and standard deviation of pre-test, post-test, and gain score were analysed by *t*-test as shown in Table 2.

As Table 2 indicates, at the beginning, the means of the three types of feedback were almost equal. On the post-test score, the means became quite different. *T*-test scores revealed a significant difference, 0.01.

Table 2. Mean and standard deviation of pre-test and post-test.

Group by Type of Feedback	Pre-test			Post-test		Gain		*t*-test
	N	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	
I.	36	12.69	2.14	17.72	2.47	5.03	1.32	22.85**
II.	36	13.61	1.88	20.50	3.31	6.89	2.09	19.73**
III.	36	13.69	2.18	18.42	2.46	4.72	1.26	22.55**
Total	108	39.99	6.20	56.64	8.24	16.64	4.67	

**p<0.01.

Table 3. Analysis of variance of gain score for different types of feedback.

Source of Variance	SS	DF	MS	*F*-test
Between groups	99.01	2	49.91	19.27**
Within groups	269.75	105	2.56	
Total	368.76	107		

**p<0.01 (SS=Sum of Squares; DF=Degree of freedom; MS=Means square).

The mean of the post-test was higher than that of pre-test scores for all types of feedback. The comparison of gain scores of these three classes was studied to find out the efficiency of feedback as the analysis in Table 3 shows.

As shown in Table 3, the *F*-test revealed a significant difference, p<0.01. Gain scores for the three types of feedback were significant. The post-hoc comparison was studied using the Scheffe method. It was found that gain scores for Type II feedback (scores and explanations), were higher than for Type I feedback (score only) and Type III feedback (scores and explanations every two weeks).

Table 4. Post-hoc comparison of gain score for three types of feedback.

Type of Feedback	Type I	Type II	Type III
Type I	-	2.78*	0.69
Type II :	-	-	2.08*
Type III :	-	-	-

*p<.05.

There was no significant difference between the score of students receiving Type I and Type III. The comparison among types of feedback is shown in Table 4.

It was found that scores for students receiving Type I feedback were significantly different on post-test scores than those of students receiving Type II feedback. Scores for students receiving Type III feedback were significant differently on the post-test than for those receiving Type II feedback. There was no significant difference on the post-test scores between students receiving Type I feedback and Type III feedback. Scores for each subgroup are shown in Table 5.

Table 5. Mean and standard deviation of score among different feedback of each subgroup.

Types of Feedback	I		II		II	
Sub Group	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
1	16.75	2.21	21.00	1.82	18.50	1.29
2	16.50	2.51	22.25	1.25	17.50	3.10
3	17.50	3.51	18.75	5.56	18.25	4.03
4	17.50	1.29	20.00	3.74	17.00	3.26
5	18.75	2.63	19.75	4.57	20.50	1.29
6	19.25	2.63	24.00	2.70	18.00	1.82
7	17.25	2.50	19.50	3.10	18.50	3.69
8	18.25	4 .11	19.50	1.73	19.25	1.50
9	17.75	0.95	19.75	2.87	18.25	0.95

It was found that students receiving Type II feedback had higher scores than any other group (mean = 18.75-24.00). However, there was indication that their scores varied from those of students in any other group (SD = .95-4.57). Scores for students receiving Type I and Type III feedback did not show a significant difference.

Research Question 2: Which of the three types of feedback was most effective in terms of participation?

Results of the participation of students receiving different types of feedback are indicated in Table 6.

Table 6. Participation of students with different types of feedback.

Type	I			II			III		
Criteria	Always (%)	Some-times (%)	Never (%)	Always (%)	Some-times (%)	Never (%)	Always (%)	Some-times (%)	Never (%)
1. Preparation	34.72	63.89	1.39	66.67	33.33	-	54.17	40.28	5.55
2. Completion of assignments	41.66	41.66	2.78	81.94	18.06	-	90.28	9.72	-
3. Sharing ideas/questions	2.78	72.22	25.00	13.89	73.61	12.50	8.33	77.78	13.89
4. Solving problems	36.11	56.94	6.94	59.72	37.50	2.78	94.44	5.56	-
5.Communicating with teacher	1.39	45.83	52.78	5.55	66.67	27.78	9.72	75.00	15.28

With respect to the category of 'always', students receiving Type I feedback showed the lowest levels of engagement in all criteria as indicated in Table 6. In contrast, percentages were highest in the 'never' category on 'sharing ideas/questions', 'communicating with instructor' and 'solving the problem'. With respect to students receiving Type II feedback, students' participation in the category of 'always' showed the highest percentages for engagement in the following: 'preparation' and 'sharing idea/questions'. With respect to Type III feedback, students' behaviours on the category of 'always' showed the highest percentages for engagement in the following: 'completion of assignments', 'solving the problem', and 'communicating with instructor'.

Discussion

Students' scores on the post-test were higher than the pre-test scores for every type of feedback. The improved scores are unlikely to be a result of using the same test for pre-testing and post-testing because there was a two month gap in between each test. However, gain scores of students receiving different types of feedback were significantly different. Students who received feedback consisting of scores and explanations once per week (Type II) received higher scores than those receiving feedback consisting of score only (Type I) or feedback consisting of scores and explanations every two weeks (Type III). Type II feedback provided more information than Type I feedback (without explanation) and provided the feedback in a more timely manner than did Type III feedback (every two weeks only).

The obtained results confirm Restine's (2008) observations that feedback is a powerful way to shape students' learning. However, the results indicate that feedback alone is not enough. The type and timing of the feedback is also an important consideration, at least in the case of this age group.

In terms of participation, students receiving Type I feedback (score only) engagement in behaviours associated with student-teacher relationships was lowest. Half of the students receiving only Type I feedback (52.78%) never communicated with their instructor and 25% never engaged in "sharing idea/question". This result coincides with the teacher's observation that students with Type I feedback paid less attention to their activities. In the case of group projects, feedback consisting only of scores might not be enough for elementary school learners. Having students receive scores plus explanations might constitute suitable feedback and the right strategy for elementary learners. Smits *et al*. (2008) investigated the effectiveness of different types of feedback content (elaborate versus global) and feedback timing (immediate versus delayed) for learning genetics in a web-based learning environment as a function of learners' prior knowledge. Their results showed a significant positive effect of global feedback on learning outcomes for higher prior knowledge learners. Students who received elaborate feedback gave a higher appreciation rating. This may be the reason why students received Type II and Type III feedback (score

with explanation) participated at a higher level than did those receiving Type I feedback alone.

According to Bischoff (2000), students need regular feedback in order to know how their performance was evaluated, how they could improve, and how their grades are calculated. Type III feedback consisting of scores plus explanations after two weeks took too long for young learners to receive in order for them to pay attention to their problems. However, it was found that almost all students receiving Type III feedback had high participation rates in terms of completing activities and solving problems. This result indicates that, for elementary learners, explanations may be essential for progress. Locke and Latham (1990) found that implementing a formal feedback when using group-work may cause spontaneous goal setting, which aids students in fulfilling tasks.

The obtained results suggest that Type III feedback consisting of scores and explanations bi-weekly may challenge students to complete tasks, solve problems, and communicate with their teacher and to work harder. Lower participation rates for those receiving the Type II feedback compared to those receiving Type III suggests that, in terms of participation, providing feedback in longer intervals may be more effective. Type II feedback, on the other hand, was most effective for achievement. However, in terms of participation, it supports only some aspects such as preparation, sharing ideas/questions.

This finding is consistent with those of a study by van den Boom *et al*. (2004), who studied "the effects of reflection prompts and tutor feedback on the development of students' self-regulated learning competence" for second-year students from a teacher training college. They found "that prompts that related aspects of self-regulated learning were perceived as less disturbing than the non-self-regulated learning competence" (van den Boom *et al*. 2004).

When feedback with scores was provided, students performed the task better but this was not enough to complete the task perfectly. In a study by Levine and Schneider (1989), feedback consisting of scores and explanations provided more information for students to help them make progress on their own task.

Conclusion

The purpose of the study reported on in this paper was to investigate elementary students' achievement and participation when receiving three types of web-based feedback in the context of a project involving collaborative learning. Participants were 108 elementary students in Bangkok, Thailand. Three types of feedback (weekly with scores; weekly with scores and explanations; and bi-weekly feedback with scores and explanations) were provided to three clusters of students. Each cluster received one of the three types of feedback. Results revealed that the highest achievement was with students who received weekly scores and explanations. Participation levels were lowest in the group receiving weekly scores only.

Given the difference in results between Type II and type II results, future research might explore in more depth the effect of delayed (two weeks or more) feedback on students' participation. When providing web-based feedback to elementary school learners, teachers should include explanations in addition to scores.

This study was limited to a context of web-based collaborative learning for Thai learners at the elementary level in two Bangkok schools. Results may be different with students in a different context. Also, the type of explanations given to the students is not reported. Results may have been different depending on the specific explanations given.

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