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Strategy Development for Learning through On-line Social Networks

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Abstract

Learning in the electronic age requires the use of various strategies by students to self-monitor their own involvement and interactive process in achieving learning tasks. Web-based environment promotes knowledge-building in the social network and increases the flexibility of the time and space for learning. Within a web-based settings, providing students with self-directed learning tasks and analyzing students' learning characteristics, specifically their collaborate strategies, are critical to the outcomes of learning. In this study, a web-based elected course, media services (for library) at the department of Library & Information Science, Fu-Jen University, was used as a case for study students' use of strategies. A set of questionnaire items in "Strategies Assessment of Web-based Project Task" (SAWPT) was developed and tested. Several issues were explored: (1) What were the strategies used by students in group online projects; (2) What were the constructs in SAWPT for assessing students' social learning strategies in achieving the project objective; (3) Were there any difference in strategy use in different interactive groups, and (4) What were students' reflections corresponding to the SAWPT.

To promote self-directed learning, group project tasks were assigned to encourage student interaction with their peers, teaching assistants, and the instructor. The study lasted for two years. In the first year, learning strategies were identified from qualitative approach. In the second year, identified strategies were translated into a set of questionnaire items (SAWPT) for assessment. Factor analysis of the items in SAWPT responded by students revealed a simple seven-factor structure. Students within different interactive levels reacted differently in following strategy constructs: "Monitoring", "Organizing and Tasking", "Decision-Making", and "Comparing and adjusting" Student learning of online group strategies was inducted to reflect SAWPT constructs.

***Key words**: social learning strategies, group learning, project learning, web-based learning, higher education*

Introduction

The topic of quality in online higher education has been explored in a number of studies (eg, Lofstrom & Nevgi, 2007; Parker, 2004). To challenge traditional classroom, learning is extended a broader context. Embracing new technology in educational practice is expected (Richardson, 2009). To promote high-order thinking on the Web, online learning must provide activities that enable learners to acquire meaningful knowledge and skills through needed interactions (Rodriguez, et al., 2006). Although the choices of various software tools available for social networks, students' learning space and niches should be defined when making use of the certain tool for self-directed learning at university courses (Pata, 2009).

There is an ongoing discussion about the potential of different forms of social networks, i.e., groups, communities, collectives, and connections. In higher education, the use of social network tools in support of groups and communities of practice has often focused on collaborative learning. This highlights the emphasis within e-learning and also more broadly within technology-supported learning on facilitating social interaction (Dalsgaard & Paulsen, 2009). To be successful in an e-learning environment, students must employ various relevant strategies that support meaningful learning (Mansour & Mupinga, 2007). Active participation within a collaborative team-approach in project works promotes autonomous learning and co-construction of knowledge among learners (ChanLin, 2008; Huang & ChanLin, 2007). Project tasks dependent on access to various social communication tools, such as discussion forum, email, and the Internet provide a means for social interaction that fosters peer coaching, exploration, and initiative-taking, while it exposes students to peers with different ideas and problem-solving techniques helpful for social construction of

meaning (Jonassen, et al., 2003).

To encourage student-centered learning by enhancing the necessary skills and knowledge development, students should be provided with opportunities to gather and analyze information about their topics, compare other cases that also have the specific attribute of their own problem, and develop a best-practice approach to the task (Brunetti et al., 2003). Project works involve students in cooperative learning can bring students to see many connections and obtain a deeper understanding of concepts and skills. It also helps students to develop self-organized learning and obtain meta-cognitive reinforcement for retaining and transferring knowledge (ChanLin, 2008).

Lofstrom & Nevgi (2007) suggest meaningful learning entails learner activity, application of constructivist principles, collaboration, dialogue, reflection, connection to context, and transferability of knowledge. Johnson, Johnson & Smith (1991) report that participants are better prepared to complete similar tasks by themselves following the cooperative lessons. Similar effects for higher education students who cooperated in group-discussions in preparing for assignments have been reported (Ramsden 2003 p. 98). Students who are engaged in project tasks are more willing to be responsible for their own learning, interested in improving their reasoning skills, problem-solving and decision-making strategies, and evaluating their own progress through self-reflection and self-monitoring (Lightner et. al., 2007). However, to ensure successful learning approach in current e-Learning context, it is essential to study how students use these strategies to achieve various academic goals, both independently and cooperatively.

In an e-Learning environment, students must know, comprehend, apply, synthesize and evaluate their knowledge in order to contribute to the learning community (Rodriguez, et al., 2006). Compared with traditional face-to-face learning settings, e-learning environment requires students to devote more time and effort in the self-directed activities geared toward promoting academic achievement in specific online learning goals (Song & Hill, 2007). Since learning strategies encompass thoughts, behaviors, beliefs, or emotions that facilitate the acquisition, understanding, or transfer of new knowledge and skills (Weinstein et al., 2000, p. 727), it is important for teachers to know what strategies are most effective in ensuring success in a particular course and how to incorporate these strategies into the course curriculum (Wadsworth et al., 2007). This information may be particularly important in online learning courses because students enrolled in these courses might have encountered the information previously and have not retained it due to inappropriate learning strategies (Wellman, 2005).

Studies have indicated that appropriate learning experiences can foster students' self-direction

(e.g., Vonderwell & Turner, 2005). Yet how the specific context impacts the development of strategies in self-direction is specific learning context is not clear (Meyer & Turner, 2002). It has been proposed that some of the personal attributes in using learning strategies are trans-contextual, while some are unique to online learning. In a web-based setting, in addition to traditional learning skills, strategies that engage students in mindful processing of information and taking responsibility for knowledge construction are essential for successful learning. An understanding of learner attributes and how these attributes impact what occurs in the online learning context is important (Song & Hill, 2007). Since online learning often situates control of implementation with the learners, students' use of learning strategies and their capabilities to regulate their own learning processes is critical to learning achievement in online learning context (Garrison, 2003; Gunawardena & McIssac, 2003). From a student perspective, a learner who is entering an e-learning environment must first form a conceptual understanding of the environment and then search for a suitable practice. The lack of social clues makes it harder for students to interpret what is actually going on in the e-learning environment (Lofstrom & Nevgi, 2007).

To prepare college students to become life-long learners, the highest priority is to make them effective learners, capable of acquiring new skills in the future (Sizoo, et. al, 2005). The widespread use of e-learning technology in higher education challenges educators to provide the pedagogical and technological knowledge needed as well as to facilitate self-directed and collaborative learning among individuals. To achieving meaningful and self-directed learning, strategic planning for the implementation of e-learning environment is crucial (Lofstrom & Nevgi, 2007). Curriculum planning and instructional decision-making regarding support for the use of technology and active involvement of learning among learners is needed.

The e-learning environment provides students with opportunities for both self-directed and collaborative study. Students' use of strategies in e-learning settings might differ from those in a traditional classroom for achieving learning goals. Specifically, this study explores: (1) the use of strategies in group online projects; (2) the development and test of a set of questionnaire items for assessing students' learning strategies for online projects; (3) the difference of strategy use in different interactive groups, and (4) students' learning reflections in line with SAWPT constructs.

Method

Learning settings

This study employed both quantitative and qualitative methods to gather research data across two academic years (2007-2008). Students enrolled in the course "Media Services" in different academic years offered by the Department of Library and Information Science at Fu-Jen Catholic University, Taiwan. In the course, various Ergonomic issues related to use of multimedia services in modern library were addressed. Students in the course intended to learn how to facilitate a healthy technological environment for library users. To achieve the learning objectives, instructional contents covering proper use of technological facility, problems related to various ergonomics, and planning for accessible environment were provided. Students were required not only learning the instructional content, but also applied what they learned to teach their clients (library users).

Project tasks were assigned in the learning process. One part of the course was designed for asynchronous online learning covering various units of instructional materials. The participants were divided into peer groups composed of three to four students involved in a group project and various online activities for group engagement and in a learning course requiring completion in 12 weeks. Students were requested to study both independently and cooperatively with peers. The online lesson units provided subject content and resource links to help students access various web-based reading materials to accomplish their project task. To prepare the final project, students were required to organize textual information and plan the production of the video materials in digital format by synthesizing what they learned and explored from various resources.

The learning tasks provided students with a self-paced learning context, so students had to regulate their time and their environment on their own. The learning system managed administrative tasks for students' learning, including: grading, announcement, and communication. Each student was required to complete various learning activities and assignments including group discussions, a midterm-exam, unit assignments, and a final group project (a study related to media service issues). Thus, this setting provided a unique opportunity to examine the learning strategies students utilized in order to manage learning in an online environment. To fulfill the course requirement, students needed to react through post on the discussion forum at least five times per week. All student interactions with their peers, teaching assistants and their instructor were documented and analyzed. Students' performance was assessed by their assignments, and the final group project.

Assessment of learning strategies

Students' use of online learning strategies was first summarized through qualitative data collection including interactive messages in discussion forums and personal reflections

(optional) from the final report. These strategies were then transferred into questionnaire items for "Strategies Assessment of Web-Based Project Task" (SAWPT) to assess students' use of learning strategies (Examples shown in Table 1). In addition to SAWPT for assessing students' online learning strategies, the study also interviewed 15 volunteered students to reflect on their learning reactions toward their project work to triangulate the research findings. Questions used for the gathering interview were listed in Table 2. An outline of research procedures for this study is listed in Figure 1.

Table 1.

Strategies Assessment of Web-Based Project Task (SAWPT)

Strategies items	Rate of frequency Very infrequent ←→ Very frequent				
Provide reading information to group members					
Search and select needed information					
Comment on information obtained					
Criticize on specific information					
Compare obtained information with practical examples					

Table 2.

Questions for Gathering Interview Data

Question example	Response to be assessed
How did you determine your project subject?	Experiences in group decision making, and how group members dealt with conflicts and reached agreement
How did you prepare your project?	Experiences in working with group project, including allotting tasks and managing time.
What was the most valuable thing you experienced from the project work?	Reactions to positive experiences and achievement they felt in the project work.
What was the most difficult part you experienced from the project work?	Reactions to problems experienced during the project work and how individual characteristics differed in responding toward the problems.
How did you solve the problems you encountered in working with the final project?	Student use of strategies of solving problems, and how students constructed their knowledge in achieving learning goals.

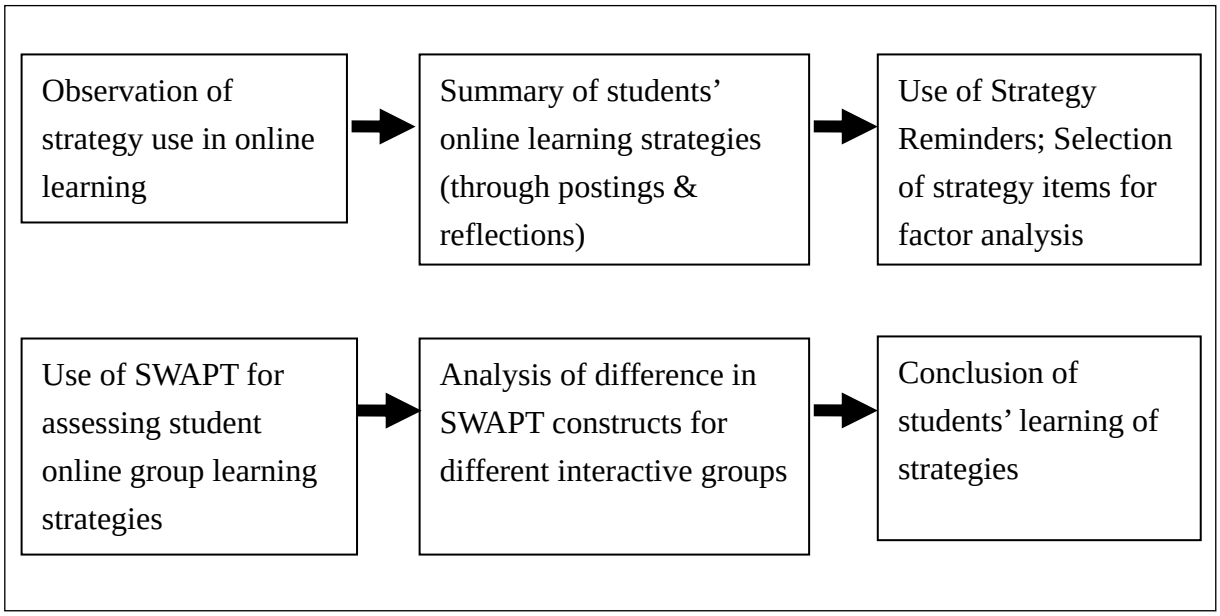

Figure 1. Outline of Research Procedures

Data Analysis

Both quantitative and qualitative analyses were used for the study. Content analysis was first used to summarize strategy items from students' postings (in discussion forums) and students' final self-reflections (in the final project). Statistical analysis was used for quantifying students' responses toward SAWPT gathered from questionnaire data. The feasibility of SAWPT developed by the study was tested by factor analysis. For referencing the qualitative data gathered in the study, different labeled descriptions were used for various data resources. For discussion postings, data collected were labeled as the "last three digits of student ID-Group #-Date" (for example: "720-07-2007-10-01") quoted from the discussion forum. For students' final self-reflection, data were referenced as the "last three digits of student ID-INT: #Line" (for example: "014-2008-01-05SR"). For referencing interview material, data were labeled as the "last three digits of student ID-Date: #Line" (for example: "428-INT:43") (Table 3)

Table 3.

Description of referenced data code

Data source	Example of reference code	Description of coding
Discussion forum	"720-07-2007-10-01"	Postings of student ID in Group 7 on October, 1, 2007
Final self-reflection	"014-2008-01-05SR"	Self-reflection of student ID on January 5, 2008
Interview	"428-INT:43"	Verbatim data of interview for Student ID on line #043

Results

Strategies in group-project work

In the academic year of 2007 students' use of self-directed strategies in achieving the learning objective were observed from various web-based activities. To summarize the use of these strategies, the postings of dialog from web-based forums and students' self reflections were used for referencing the data. Students' learning from a project work entailed their active involvement. Strategies observed were tentatively categorized into three important purposes: "processing information", "monitoring time and group actions/interactions", and "preparing the components for final project" (Table 4). Various interactive strategies in processing information included sharing, searching, commenting, comparing, abstracting, selecting information, and etc. The use of these strategies revealed the importance of appropriate use of information.

Various strategies were use to monitor group effort and use of time, such as encouraging others, self-reviewing, reflecting, and expressing ideas. *S*tudents also frequently remind themselves and others to carry out the group project. To reach a specific decision in their project work, students gathered and organized information needed, and varied or agreed on their opinions for broadening their understanding.

Various strategies were observed in preparing the components of final project. Along the process of preparing their projects, students produced, refined and adjusted their own work. They strived for learning goals, and reinforced their involvement in the allocated task. They extended and elaborated on specific issues for study, detected problems and self-explored problem solution. They also made necessary revisions based on self-review process. Detailed examples are listed in Table 4.

Table 4

Strategies used in the online learning context

Purpose	Strategies	Example observed from online learning
Processing information	Provide reading information to group members	"The above case has been discovered in the 19 century." (073-09-2007-10-26)
	Search and select needed information	"Here is the information about Neurology I identified from Science Online: …."(720-07-2007-10-11)
	Comment on information obtained	"I would like to comment on one point from the information obtained. Besides definition, organization issues need to be emphasized."(732-07-2007-11-29)
	Criticize on specific information	"I would like to address a different point from what you said. Although this is an important issue, no one really cared about its influences until 1984." (471-04-2007-11-29)
	Compare obtained information with practical examples	"From my experience working with them, I feel that teaching them how to learn is equally important." (190-02-2007-12-13)
	Relate personal life experiences with received information	"After reading this information, I know how to deal with the problems myself in the future." (188-01-2007-12-04)
	Link work experiences with received information	"My previous work experiences were similar to this case." (360-06-2007-10-11)
	Identify key principles for organizing information	"When using the information, we need to select some from the print-based materials from more reliable resources." (720-07-2007-12-23)
	Identify main ideas from given information	"The key issue from the article is that the aging population will also benefit from accessibility design of the computer and media center." (073-09-2007-12-13)
	Self-check reliability of given information	"The information I sent earlier might not be from a reliable source. The author's name was not provided in the paper. We need to look for other more reliable resources." (794-10-2007-10-23)
	Identify possibility of resource unreliability	"Most of the information available online is from commercial websites. We should not rely too much on these types of resources." (619-05-2007-11-27)
Monitoring time and group actions / interactions	Provide input for improvement	"I need to correct my previous input. The correct website should be http:…." (043-04-2007-11-22)
	Praise group peers for their effort	"You worked harder than rest of us. We admire you!" (304-04-2007-12-18)
	Praise competitive groups for their learning outcomes	"Take a look at other group. They have done a great job in putting the pieces together." (528-03-2007-10-18)
	Attend to one's own outcomes	"I did not do a good job before. I will do my best from now on." (619-05-2007-12-30)
	Identify one's own weakness	"I am careless and made frequent mistakes." (578-05-2007-10-15)

	Be aware of one's own strengths	"I am good at this issue of study. I gathered abundant information in this area." (619-05-2007-11-26)
	Confirm received instruction	"Teacher! Do you suggest us to access the occupational safety and health information listed?" (152-02-2007-10-21)
	Confirm learning tasks to be accomplished	"I have just checked the syllabus. This is what we need to work on this week." (794-10-2007-11-25)
	List personal tips	"Here are my own tips for reminding myself…." (140-02-2007-11-18)
	Reflect on work experiences	"During the summer service camp, I experienced the problem myself due to extensive cataloging work." (205-06-2007-10-08).
	Remind others about time and progress	"Cheng-Yi, Teacher has already mentioned this. Please pay more attention." (205-06-2007-10-08)
	Remind oneself about time and progress	"I have an assignment and a test on next Monday for other courses. Therefore, it is better for me to do it tomorrow. Please give the stuff you have so that I can put together." (528-03-2008-01-04)
	Reflect on one's learning experiences	"The use of various media is become popular in every field. Proper procedures can prevent some application problems." (102-08-2008-01-05)
	Express learning difficulties	"The content is hard for me. I need to digest for a while before I can put it in the project." (413-05-2008-01-04)
	Vary from others' opinions	"I don't agree with you. Appropriate budget use should be based on the needs of the majority of people." (035-09-2007-12-18)
	Express disagreeable argument on specific issues	"Why are women more vulnerable? The results of studies might vary." (188-01-2007-10-11)
	Respond positively toward agreeable argument on specific issues	"I agree with you. Talk to you about the details later." (774-04-2007-11-29)
	Confirm specific decisions	"No problem. This should be it." (671-10-2007-11-28)
	Provide suggestion to help group interaction	"Let's set up a time to discuss it online." (633-10-2007-11-28)
	Preserve socialized connections	"You teach me next time. Good stuff should be shared with friends." (043-04-2007-10-27)
	Learn by helping others learn	"I suggest you use NDDS (National Document Delivery System) to get full-text articles." (542-06-2007-10-15)
	Initiate interaction	"Please read the information on the website:…and put your reflections here." (504-01-2007-11-19)
Preparing the components for the final	Extend and elaborate on specific issues	"…From the website, several standards have been issued for prescribing work conditions." (043-04-2007-11-29)
	Strive for learning goals	"We strived for the points and worked toward reaching our goals." (188-2008-04-17)

	Follow course requirements	"We need to submit our progress status every two weeks for the course management system." Each submission is worth credits." (521-2008-04-17)
	Follow requirements for preparing the project	"The teacher asked us to correctly cite the references when preparing the project. We need to learn how to do it according to the instruction." (014-2008-01-11)
	Follow class rules	"Using bad language is not allowed in the class. We need to follow the rules among group members." (102-08-2007-11-29)
	Review one's own time involvement	"I spent more time on the online course than other face-to-face courses." (043-2008-01-05SR)
	Review one's own contribution in project	"In the final projects, I summarized the ideas and references from the information collected by group members." (720-2008-01-04SR)
	Examine each component of the project	"We had a checklist about what should be included in the final project. We checked whether we had prepared everything required for the final project." (205-2008-01-05SR)
	Self-review and correct mistakes	"We corrected some of mistakes found in the references for the final project." (158-2008-01-03SR)
	Detect problems	"We used a translator tool for the information written in English. But the information was not translated well." (304-2008-01-04SR)
	Self-explore problem solution	"The teacher encouraged us to find information from the electronic academic database. We tried and got valuable information from PubMed" (201-2008-01-04SR)
	Be positive about group member's effort	"Everyone in our group did a great job. We were happy to work together as a team." (043-2008-01-04SR)
	Reinforce one's own involvement in the allocated task	"Since each one of us (in the team) needed to finish his or her allocated task, I felt I needed to reinforce my involvement to fulfill my own duty." (255-2008-01-05SR
	Guard against laziness	"We (group members) monitored each other's effort so we could identify who did not do his or her job." (304-2008-01-04SR)
	Compare with others' works	"When we looked at the job other groups had done, we knew that we had to work harder to make good progress." (471-2008-01-04SR)
	Adjust according to comparison	"After knowing what the other group had done, we adjusted our group effort by including a greater variety of referenced information to support our points." (201-2008-01-04SR)
	Review for project improvement	"After putting our parts (individual works) together, we looked at the consistency of each component. Each of us might use different terms to specify the same thing." (794-2008-01-05SR).

P.S. The number within the parentheses stands for "Student id-Group id-Year-Month-Date"

Strategy Reminders

The strategies identified from students' learning process (in the academic year of 2007) were used as reminders (in the academic year of 2008) to help student use these learning strategies. Three online teaching assistants worked as facilitators to help students develop the strategies needed for the learning process. Teaching assistants' constant reminding was observed from online interaction. For example, through gathering and organizing relevant information and materials for the final project, the following reminder notes were often observed from online discussion forums: "Where did you get this idea?" "Don't forget to provide a detailed citation." "How would you reflect on the information you read?" "How are these descriptions related to your work and life experiences?" "Could you elaborate more about the information you gave?" "Do not rely on an online translator! Interpret the information on your own!"

To help students monitor time and group actions, the teacher and teaching assistants frequently reminded students about the time and progress of each group. "You need to manage your time. Don't wait until the last minute to work on your final project." "Guys, you need to hurry. Friday is the due day!" "All of your group members need to participate in the decision-making process." "You won't be able to decide the topic of the final project until a thorough discussion has been made among team members." "You haven't talked to your group member this week yet." "Everyone in the group should be responsible for his or her own task." "Group members should work as a team to accomplish the final project."

Preparing final projects required students' understanding of learning materials and the tasks to be accomplished. As well as answering and correcting students' misinterpretation of learning materials and gathered information, the teacher and teaching assistant often provided guidelines to students. For example, the following examples were commonly observed from the discussion forums. "You need to outline what should be included in your final projects." "As well as verbal information, you need to plan for visual materials for presenting important concepts." "From your introduction, you misinterpret the information, please read it carefully and make the needed revisions." "Please refer to the guidelines for preparing the final projects." "There is some disagreement about the terms used in different components of the materials you prepared." "You need to integrate the components of the final project as a whole to present it in a systematic way." Detailed examples are listed in Table 5.

Table 5

Example of strategy reminders

Purpose	Example
Processing information	"Where did you get this idea?" "Don't forget to provide a detailed citation." "Could you re-organize what you have posted?" "Could you explain what exactly you meant?" "How would you reflect on the information you read?" "How are these descriptions related to your work and life experiences?" "Could you elaborate more about the information you gave?" "Do not rely on an online translator! Interpret the information on your own!"
Monitor time and group actions/ interactions	"You need to manage your time. Don't wait until the last minute to work on your final project." "Schedule your time for allotted tasks." "Guys, you need to hurry. Friday is the due day!" "All of your group members need to participate in the decision-making process." "You won't be able to decide the topic of the final project until a thorough discussion has been made among team members." "You haven't talked to your group member this week yet." "Everyone in the group should be responsible for his or her own task." "Group members should work as a team to accomplish the final project."
Preparing the components of the final project	"You need to outline what should be included in your final projects." "As well as verbal information, you need to plan for visual materials for presenting important concepts." "You have not yet set up a time for video-shooting." "From your introduction, you misinterpret the information, please read it carefully and make the needed revisions." "Please refer to the guidelines for preparing the final projects." "There is some disagreement about the terms used in different components of the materials you prepared." "You need to integrate the components of the final project as a whole to present it in a systematic way."

The Strategies Assessment from SAWPT

Students' use of learning strategies was summarized and transferred into the questionnaire items in SAWPT. Eighty-three students' responses to SAWPT were gathered. Among

these strategies, 30 were positively correlated with learning outcomes (project score) ($p < 0.05$). These 30 items were then selected for factor analysis.

Kaiser-Meyer-Olkin (KMO) measure of 0.804 indicated a high sampling adequacy for the factor analysis among the 30 strategies. Bartlett's test of sphericity, which tested whether the correlation matrix was an identity matrix, was significant ($p<.000$). This indicated that the factor model was appropriate. The thirty items were subjected to factor analysis using the principal factor method to extract the factors, followed by a promax (oblique) rotation. A screen test and proportion of variance suggested seven meaningful factors were retained for rotation if the loading was 0.5 or greater for that factor, and was less than 0.5 for the other factors. Factors and item loadings are shown in Table 6. From the analysis, seven major factors were elicited, and all of the 30 items were selected.

The seven items loaded on Factor I labeled “Monitoring”. Factor II, labeled “Organizing and Tasking”, included five items. Seven items loaded on Factor III, labeled “Decision-Making”; four items loaded on Factor IV, labeled “Reflecting”; three items loaded on Factor V, labeled “Refining”, two items loaded on Factor VI, labeled “Refining”; two items loaded on Factor VII, labeled “Comparing and Adjusting”, and two items loaded on Factor VII, labeled “Identifying Weakness”. The accumulated variance reached 65.553. The homogeneity of each factor was examined using Cronbach alpha. Reliability analysis revealed all factors had satisfactory reliability (Table 6).

Factor I “Monitoring” involves strategies to self-review one’s time control and involvement and contribution to a group, provide suggestion to help group interaction and be positive about the group’s effort, follow class rules, and reinforce one’s own involvement in the allocated task. These strategies stress the skills needed to monitor individuals’ effort in group work. Factor II, “Organizing and Tasking” refers to the strategy students use to comment, confirm, and synthesize their understanding of the assigned task. These strategies help students confirm what has been learned and what needs to be accomplished, and comment on the obtained information. These strategies are needed for achieving learning tasks. Factor III “Decision-Making”, encompasses skills enabling students to express disagreeable and agreeable arguments on a specific issue, confirm a decision, search for and select needed information, extend and elaborate on specific issues, vary from other’s opinions, and provide input for their project work. These strategies emphasize the critical thinking process needed in decision-making.

Factor IV, “Reflecting”, emphasizes on skills necessary for reflecting on individual and group effort in project work. These strategies also help students to review for project improvement, guard against laziness, and self-review one’s experiences in learning and working. Factor V,

"Refining", involves the skills to enable students to constantly review for improvement and refinement in group project work, including extracting main ideas, examine and correct mistakes. Factor VI, "Comparing and Adjusting", focuses on the strategies students use to compare and adjust their own work and effort. Factor VII, "Identifying Weakness", includes strategies to identify flaws and weakness in the project work.

Table 6
Factor analysis of SAWPT

Item	Correlation with outcomes (p-value)	Loading	Accumulated Variance (%)	Alpha Value
Factor 1: Monitoring			34.645	0.845
1. Review one's own time involvement	0.313 (0.004**)	0.843		
2. Review one's own contribution in project	0.374 (0.000***)	0.819		
3. Provide suggestion to help group interaction	0.338 (0.002**)	0.728		
4. Be positive about group member's effort	0.379 (0.000***)	0.707		
5. Follow class rules	0.348 (0.001**)	0.672		
6. Reinforce one's own involvement in the allocated task	0.395 (0.000***)	0.647		
7. Remind oneself about time and progress	0.227 (0.039*)	0.500		
Factor 2: Organizing and Tasking			41.226	0. 835
8. Comment on information obtained	0.289 (0.008**)	0.792		
9. Confirm received instruction	0.249 (0.023*)	0.774		
10. Follow requirements for preparing the project	0.476 (0.000***)	0.714		
11. Confirm learning tasks to be accomplished	0.348 (0.001**)	0.655		
12. Strive for learning goals	0.322 (0.003**)	0.628		
Factor 3: Decision-Making			47.737	0.822
13. Respond positively toward an agreeable argument.	0.374 (0.001**)	0.847		
14. Confirm specific decisions	0.383 (0.000***)	0.781		
15. Express disagreeable argument on specific issues	0.294 (0.007**)	0.772		
16. Search and select needed information	0.304 (0.005**)	0.630		
17. Extend and elaborate on specific issues	0.237 (0.031**)	0.602		

18. Vary from others' opinions	0.365 (0.001**)	0.580		
19. Provide input for improvement	0.218 (0.048*)	0.549		
Factor 4: Reflecting				
20. Review for project improvement	0.232 (0.035*)	0.813	53.260	0.711
21. Guard against laziness	0.395 (0.000***)	0.701		
22. Reflect on oneself learning experiences	0.271 (0.013*)	0.632		
23. Reflect on work experiences	0.307 (0.005**)	0. 596		
Factor 5: Refining				
24. Identify main ideas from given information (RM)	0.258 (0.019*)	0.729	57.710	0.733
25. Examine each component of the project (XB)	0.301 (0.006**)	0.640		
26. Self-review and correct mistakes	0.258 (0.019*)	0.618		
Factor 6: Comparing and Adjusting				
27. Compare with others' works	0.283 (0.009*)	0.863	61.729	0.796
28. Adjust according to comparison	0.379 (0.000***)	0.741		
Factor 7: Identifying Weakness				
29. Identify possibility of resource unreliability	0.248 (0.024*)	0.762	65.553	0.700
30. Identify one's own weakness	0.320 (0.003**)	0.691		

Extraction Method: Principal Component Analysis;
Rotation Method: Promax with Kaiser Normalization

SAWPT in Different Interaction Groups

Mean scores on SAWPT measure to examine students' use of strategies is listed in Table 7. Students' electronic postings served as an indicator to differentiate tow interaction group: high interactive (the number of postings above minimum requirement - 5 per week) and low interactive (the number of postings above minimum requirement - 5 per week) groups. Fifty students were identified as high interaction (60%), and thirty-three (40%) were low interaction. Differences of SAWPT constructs between high and low interaction groups were tested. The comparison of SAWPT constructs in use of project strategies between low and high interactive groups indicates significant differences in the following constructs: Monitoring ($t_{81} = -3.167$, $p = 0.002$), Organizing and Tasking ($t_{81} = -2.463$, $p = 0.016$), Decision-Making ($t_{81} = -2.432$, $p = 0.017$), and Comparing and Adjusting ($t_{81} = -2.957$, $p = 0.004$) (Table 8).

Table 7
Students' mean scores on SAWPT measures

Strategy Measure	Construct Mean		Item Mean	
	Mean	SD	Mean	SD
Monitoring (7 items)	24.28	4.72	3.49	0.71
Organizing and Tasking (5 items)	17.54	3.74	3.51	0.75
Decision-Making (7 items)	22.60	4.64	3.23	0.66
Reflecting (4 items)	12.67	2.78	3.12	0.70
Refining (3 items)	9.71	2.31	3.24	0.77
Comparing and Adjusting (2 items)	6.55	1.77	3.28	0.88
Identifying Weakness (2 items)	5.82	1.67	2.91	0.83

Table 8.
Differences in SAWPT measures between different interactive levels

SAWPT construct	Low interactive N = 33	High interactive N = 50	Comparison	
	Mean $\pm$ SD	Mean $\pm$ SD	t	p
Monitoring	3.20 $\pm$ 0.86	3.68 $\pm$ 0.52	- 3.166	0.002**
Organizing and Tasking	3.27 $\pm$ 0.84	3.67 $\pm$ 0.64	- 2.4632	0.016*
Decision-Making	3.02 $\pm$ 0.53	3.37 $\pm$ 0. 53	- 2.432	0.017*
Reflecting	3.17 $\pm$ 0.88	3.09 $\pm$ 0. 54	0.521	0.604
Refining	3.09 $\pm$ 0.88	3.33 $\pm$ 0. 68	-1.410	0.162
Comparing and Adjusting	2.94 $\pm$ 0. 98	3.50 $\pm$ 0.74	-2.957	0.004**
Identifying Weakness	2.92 $\pm$ 0.98	2.90 $\pm$ 0.74	0.129	0.898

*p < 0.05; ** p <0.001

Confirmation of learned strategies
To confirm the strategies identified and tested, an in-depth interview at the end of the course was conducted. Interview data from the online group learning process showed students not only achieved their project goals, but also learned strategies essential for group work. Students' reactions were summarized based on the facets identified in factor analysis for SAWPT (Table 9). From these reactions, students' reactions toward the process of achieving project goals revealed the use of following strategies "Monitoring", "Organizing and Tasking", "Decision-Making", "Reflecting", "Reflecting", "Refining", "Comparing and Adjusting", and "Identifying Weakness".

In the category of "Monitoring", students used strategies in reviewing their own time involvement and contribution in preparing the project work. Some groups had a leader to remind team members of things to-be-done. Interaction with members was an essential strategy in accomplishing group tasks. Students also leaned to be positive about other's effort and learned how to work individually and collaborate with others to reinforce their involvement. In the category of "Organizing and Tasking", it was observed students first

learned instructional materials as a basis to synthesize their understanding of knowledge to achieve the assigned task. Students also read and commented on what they obtained to make sense about what should be included in their project work. They confirmed what they learned and what needed to be accomplished, so project content relevant to their project could be well prepared. They also allotted tasks based on project requirement, and strived for achieving their goals. In the category of "Decision-Making", students expressed disagreeable and agreeable argument toward a specific issue. Various opinions were presented, extended, and elaborated from the searched and selected information. Necessary input was provided to group members. From the processes, students learned important skills in decision-making process. Details of the examples are listed in Table 9

In the category of "Reflecting", it was observed that students used strategies to self-reflect and -review for improving group project work. They also guarded against laziness among group members and related their learning to future work experience. In the category of "Refining", the strategies students used to organizing materials for presentation of knowledge were observed. They carefully examined, and reviewed the project work. They also made necessary revisions for refining the components of their project work.

In the category of "Comparing and Adjusting", students compared their work with others and adjusted their production work. For example, students rearranged the themes to create more interesting angles for their work, after learning from other groups' work. In the category of "Identifying Weakness", strategies to identify flaws and weakness in project work were noted. For example, students identify resources vulnerable to unreliability. Details of the examples are listed in Table 9.

Table 9.
Confirmation of SAWPT from Interview Reactions

Item	Interview Data
Factor 1: Monitoring (Keeping one's involvement in a task.)	
1. Review one's own time involvement	"I was too far behind at that time. I told myself I had to spend more time on the group task." (599-INT:65)
2. Review one's own contribution in project	"To include an introductory movie on the project, I planned the video-shooting ahead of time. I was also one of the actors for three important scenes. I rehearsed several times before shooting those scenes." (604-INT:135-146)
3. Provide suggestion to help group interaction	"I was the group leader of our team. To help us communicate more effectively, I reminded each team member of the minimum discussion time." (061-INT:53-54)
4. Be positive about group member's effort	"Each of us was involved in his or her own part." (185-INT:39-42). "Some of the project work required us to work together. Everyone's contribution in this project was important." (185-INT:47)
5. Follow class rules	"We reminded each others about what should be followed in attending on-line classes, and what should be cited when posting information"(185-INT:75-76)
6. Reinforce one's own involvement for allocated task	"I worked on allotted tasks individually. However, working together with group members was also needed to review and reinforce individual work through comments from others." (185-INT:90-91)

7. Remind oneself about time and progress	"I scheduled my time for the tasks and reminded myself to finish each of them on time." (059-INT:130-131)
Factor 2: Organizing and Tasking (Choosing what are needed to accomplish a task.)	
8. Comment on information obtained	"Providing comments on information written in English was more difficult for me." "We needed to read and comment to make critical decisions about the selection of information." (094-INT:140-141; 147)
9. Confirm received instruction	"To prepare the project work, we needed to have basic knowledge of the area of study. I studied the instructional materials first and confirmed what I had learned." (185-INT:21-22)
10. Follow requirements for preparing a project	"The project required both presentations of verbal and visual information. To fulfill the requirement, different tasks were allotted." (343-INT:43-45)
11. Confirm learning tasks to be accomplished	"We were sure we were on the right track. We also noticed the video we produced should be relevant to the topic of our study."(599-INT:165-166)
12. Strive for learning goals	"To be honest, all of us worked hard to get a good grade. Through the process of striving for a good grade, we learned to gather, select, organize, present knowledge, and achieve our learning goals" (070-INT-158-163)
Factor 3: Decision-Making (Choosing what are needed to accomplish a task.)	
13. Respond positively toward agreeable argument on specific issues	"We agreed on the objective of our final project at the beginning of planning. All of us considered this issue important."" (279-INT: 22-26)
14. Confirm specific decisions	"We made decisions based on thorough discussion among team members. We also had everyone confirm the decision we made so we could plan for follow-up tasks." (563-INT:26-29)
15. Express disagreeable argument on specific issues	"We felt the ideas the TD provided were not exactly what we wanted to emphasize. Therefore, we did not accept his suggestion."(0267-INT:43)
16. Search and select needed information	"The information gathered from the Internet was fragmented. We read and selected materials from the database to obtain more reliable resources." (044-INT:87)
17. Extend and elaborate on specific issues	"To achieve the purpose of our project, we should make the knowledge more applicable to the audience. Various points should be elaborated on by citing relevant examples." (563-INT:151-53)
18. Vary from others' opinions	"To provide option in deciding a topic of research, each one of us contributed an idea." (604-INT:21)
19. Provide input for improvement	"I suggested that we should rearrange our manpower. More was needed in shooting the video" (604-INT:167)
Factor 4: Reflecting (Keeping one's involvement in a task.)	
20. Review for project improvement	"We felt we did not explore many details of the lighting. More information was included after group review" (061-INT:128-130)

21. Guard against laziness	"Every group member should be responsible for his or her own allotted task. We kept a close watch on one another's work and guarded against laziness among group members." (097INT:147-150)
22. Reflect on one's learning experiences	"It was a wonderful learning experience. We learned how to organize information, put together important ideas, and decide how to integrate into video information to present the important concepts." (408-INT:296-302)
23. Reflect on work experiences	"We related the project to our work experience. The themes we used were the routine works for a librarian, such as computing, cataloging, and book-shelving." (059-INT:61-63)
Factor 5: Refining (Making improvement for a task.)	
24. Identify main ideas from given information	"The information obtained from the Internet was not organized. We screened relevant materials, and organized them based on the video themes." "Though this organization, the information was more relevant to real-life situations."" (343-INT:160-161; 171-173)
25. Examine each component of the project	"We took turns to examine the components of the project. Each of us provided information and integrated all the parts." (279-INT:65-66)
26. Self-review and correct mistakes	"We corrected some mistakes and re-shot the movie for the project. Some of the scenes were repeated several times." (408-INT:271-272)
Factor 6: Comparing and Adjusting (Making improvement for a task.)	
27. Compare with others' works	"We noted the project work prepared by other groups were more creative. Some groups used various episodes to present practical examples in their project works." (279-INT:199-200)
28. Adjust according to comparison	"After comparing with other groups' work, we felt we needed to make the visual information more appealing. We rearranged the themes to create more interesting angles." (097-INT:320-322)
Factor 7: Identifying weakness (Making improvement for a task.)	
29. Identify possibility of resource unreliability	"The resources obtained through Google were not reliable. Some of the information we found was copy-and-pasted from other websites. We felt we should search more reliable resources." (044-INT:079-80)
30. Identify one's own weakness	"In reviewing our project work, we found we forgot to include movie clips we had prepared for providing a brief introduction." (044-INT:124)

Discussion

There is a large body of literature indicating that learning strategies are important (e.g. Lee, 2002; Weinstein, et al., 2000). While self-regulation has often been linked to learning strategies of college students (Zimmerman, 2002), group-learning strategies used among students were even more important to reflect current web-based learning context. This study has examined students' use strategies in the context of an online learning approach. The

social network tool used in web-based learning has made students' use of learning strategies more diverse and easily examined.

In this study, various group-learning strategies were identified and selected as constructs for assessing student group learning strategies in SAWPT, including: "Monitoring", "Organizing and Tasking", "Decision-Making", "Reflecting, Refining", "Comparing and Adjusting", and "Identifying weakness". The project tasks offer students a self- and group- monitoring learning opportunity to obtain both knowledge and meta-cognitive skills that are different from traditional classroom learning context (ChanLin, 2008).

From the findings of this research, students in the high interactive level scored higher in some SAWPT constructs ("Monitoring", "Organizing and Tasking", "Decision-Making", and "Comparing and Adjusting") revealed the interactive level might be an indication for students' use of strategies in online web-based learning. Involvement of interaction is relevant to the use of appropriate social strategies to accomplish the project work. The cooperative effort observed from students' interaction also reflected their involvement and participation of the learning activities in the web-based learning context, which might foster each participant to become a self-directed learner in his or her own learning.

In group-oriented learning activities, collaborative learning is the actual social engagement and exchange between the members of a group, the process of working and interacting together to arrived at a solution to the learning task (Hutchinson, 2007). The study found that the online environment was well suited for collaborative group work. However, to be successful, students have to monitor their perceptions and actions, set proximal goals and employ strategies when encountering difficulties or problems (Lofstrom & Nevgi, 2007; Zimmerman, 1990). In this study, frequent use of guidelines and reminders was essential to help students develop appropriate strategies needed in group-collaboration.

The use of guidelines and reminders helped students to develop a wide range of skills necessary in accomplishing the group project task, including: monitoring, organizing and tasking, decision-making, reflecting, refining, comparing and adjusting, and identifying weakness. Similar to findings summarized in Heye & Steven's study (2009) in examining students' improvement in health care practice in nursing, the study also found that coordinated and cooperative activities within student groups stimulated decision-making and organization of information, which was crucial in translating knowledge to practice through team collaboration. Informal teaching moments occurred when conflicting opinions and questions arose in groups and were referred to the teacher and teaching assistants for resolution or corroboration. Teaching assistance with student groups online provided an opportunity to assess gaps in student knowledge and skills, and to provide guidance for group

work at critical junctures. Students learned about professional roles through the preparation of presentation of their topic.

Conclusion

This study examined the use of learning strategies among college students in a web-based setting. The collaborative learning and social engagement in online interactions among students contributes to a more self-directed learning and appropriate use of strategies in achieving group tasks and individual learning goals. The use of SAWPT might be applied to other group learning settings for assessing students' use of strategy for achieving group project task. However, due to the limitation of population covered in the study, further research to confirm the feasibility of the constructs is needed before future application. This study also noted that the role of interaction and collaborative effort extends traditional notions regarding the use of strategies and self-regulation. Students used strategies for achieving both academic goals and communication objectives. However, this research is preliminary, it is important to conduct further investigations before drawing any implications for practice.

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