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An Internet Environment for Type-C Note Taking

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ABSTRACT

The present article describes the design of an Internet learning environment in which users cooperatively create study notes. A note taking process incorporating an effective study procedure was adopted in the computer system design, and the system was implemented an experimental psychology course. Using the system, the members of a study group study and take notes according to the following procedure. (1) The members preview the learning materials and ask questions about the important information the materials convey. (2) The members discuss and divide the materials into equal parts. (3) One member reads his/her share of material, answers the questions previously raised, and writes the answers in his/her notes. (4) Together, the members review and discuss the notes taken by each member, and integrate the notes so that each member has a copy. A questionnaire study was conducted to collect the attitudes toward the environment of a group of college students who were either taking the experimental psychology course or had taken the course before. The results of the study indicated that the subjects thought the system promoted learning effectiveness and interaction between group members.

Key Words: studying notes, cooperation, Internet

I. Introduction

Note taking has been shown to help learning by enhancing a person's memory of the materials s/he has studied, thus helping the person gain good marks on the tests on the materials (Kiewra, 1985). One particular type of notetaking behavior that is common among college students in Taiwan (Pan, 1993) was of special interest in the present study. When college students are taking a difficult course, they are likely to form study groups. The members of each group often share the study notes they have taken during the professor's lectures or excerpts from textbooks, and help each other with the class assignments. Moreover, to cut down on study time, the members not only share their notes, but also divide the learning materials into equal parts, so that each member needs to study only one part. After studying individually, they exchange their study notes so that each member possesses a copy of the study notes created by all the members of the group. Such notes will be referred to as the type-D study notes in the following text, where "D" stands for job "division."

Cooperative learning is reported to have many advantages, such as promoting academic achievement and cross-cultural understanding, over other types of learning situations (*e.g.*, traditional individualistic learning or competitive learning (Johnson & Johnson, 1999)). Although it takes many forms and definitions, cooperative learning usually involves a small team consisting of four or five members, each with a different background or expertise. The team works together on a content specific task in which each member is individually accountable for part of an outcome that can not be completed unless the members work together; thus, there is a sense of "positive interdependence" among group members (Slavin, 1983). In the 14 key elements of successful cooperative learning (Stahl, 1994), face-to-face interaction is been identified as the basic essence of cooperative learning. In addition, Kagan (1993) argued that the members of a group should interact according to a "structure of interaction" or "a set of processes" designed to facilitate their interaction.

The goal of the type-D notetaking method is specific and clear, and to achieve the goal each member depends on the other members accomplishing their tasks. These features are included in the 14 key elements of successful cooperative learning; thus the type-D notetaking method has the characteristics of cooperative learning. However, it should be noted that little interaction and absolutely no structure of interaction imposed on group members, when they are creating the type-D notes, which violates a basic requirement of cooperative learning. Moreover, there are

other shortcomings associated with the type-D notetaking method. First, there are individual differences in comprehension and notetaking ability. Thus, the quality of the notes is likely to differ from one person to another. Secondly, dividing learning materials into a number of parts is likely to detach the information contained in one part from its context, which will affect the learner's understanding of the information. Thirdly, because little interaction (discussion or information exchange) among group members is involved, the type-D notetaking method does not allow students to develop "evolving" knowledge from the information being studied, while studying in a group, or cooperative learning, should afford such knowledge development.

The purpose of the present research was to design a notetaking (or learning) environment (or system[1]) which allows its users to study, and take notes, in group on the Internet. In particular, users of the system are required to follow a specific notetaking procedure while collectively creating study notes. The notetaking procedure the system employs is designed to provide one key element of cooperative learning (i.e., structured interaction) that the type-D notetaking method lacks. The procedure consists of four notetaking stages modified from the procedures usually employed in effective study methods (*e.g.*, PQRST, PR4R and SQ3R) (Robinson, 1970; Shepherd, 1992). Following are the 4 notetaking stages.

(1) Preview and Questioning: The members of a study group preview the materials to be studied, and raise questions concerning the important messages the materials aim to convey[2].

(2) Assignment: The group members discuss how to divide the materials of a learning unit into equal parts, and each member chooses a part according to his/her interest or expertise to study.

(3) Read: Each member reads the materials assigned to him/her. In particular, s/he reads the materials in order to answer the questions raised by all the members in the Preview and Questioning stage, and notes down the answers.

(4) Discussion and Integration: All the members review and discuss the notes took by each member. If questions or comments are raised about a note, the person who wrote that note should reread the learning materials and revise the note in light of the questions or comments. Finally, following discussion and after the notes are accepted by all the members, the notes are integrated into a unified copy. Each member gets a copy of the notes written collectively by all the group members.

As mentioned above, the type-D notetaking method does not qualify as cooperative learning because it does not enforce processes that help people interacting. It is argued that if a system employs the four stages of the notetaking procedure described above, then the system will create a type-C notetaking environment, where "C" stands for cooperation, because the system requires the users to discuss and exchange ideas throughout the entire notetaking process.

Moreover, for the following reasons, it is argued that a user of the system not only enjoys the advantages, but also avoids the disadvantages associated with the type-D notetaking method. First, in the Read stage, although a person reads only a part of the materials, s/he can use the macro-structure of the materials built in the Preview stage to guide reading and to incorporate the information contained in the part of materials assigned to him/her in the macro-structure. Secondly, the person reads in order to answer the questions raised in the preview stage by all the members of the group, which allows him/her to build knowledge actively instead of memorizing isolated information passively. Thirdly, in the Integration stage, all the notes taken are reviewed by all the members. If any member does not understand the materials or if important information is missing in the notes, it will likely be spotted because the knowledge the members possess related to the learning materials is complementary. Finally, the system is built on the Internet, so users are not limited to using the information stored in the system to answer the questions; there is a good possibility that they will be able to develop knowledge beyond the professor's original design, because they can access information other than the materials the professor assigned.

The ideas mentioned above have been implemented in an experimental psychology course taught by the first author. Using the cooperative notetaking environment, students formed groups to access the learning materials prepared for the course.

II. The Type-C Notetaking Environment

To access the learning materials prepared for the experimental psychology course taught by the first author, students had to form study groups. The course (materials) was divided into 23 teaching, or learning, units. The teaching materials actually used in the class consisted of texts, figures, videos, computer programs designed for conducting psychological experiments etc., but in the present research, only texts and figures were included in the system.

[1] To enhance reading, the terms "system," "notetaking environment," and "learning environment" are used interchangeably in this article.

[2] A short article stored in the system introduces the concepts of effective study. In the article, students can find information concerning how to preview learning materials and how to ask questions.

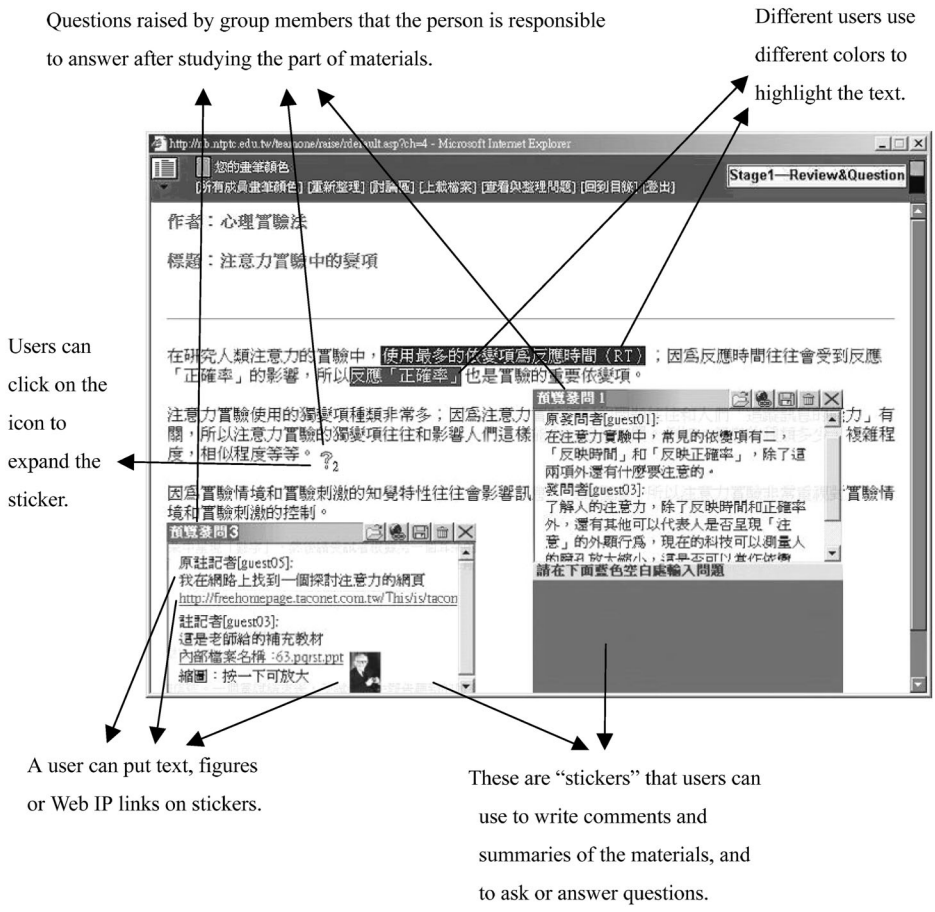

Fig. 1. The design of the learning environment.

While reading using the system, a student can use a unique color of his/her choice to highlight the learning materials and write comments or summaries of the materials on "post-it" like windows (called "stickers" here; Figs. 1 and 2). The sticker windows can be posted anywhere in the materials for the others to read. The student can also post figures or IP links which contain information relevant to the learning materials using the sticker system. To ensure that all the members of a group participate in the discussion, a table inside the system is designed to keep track of which notetaking stage the group is in, and in a particular stage, which members have asked questions or provided comments and which members have not. When all the members have participated in the discussion, the system will send a probe to ask the users whether or not they want to switch to the next notetaking stage.

Essentially, the notetaking functions of the present system are similar to that of the other systems with notetaking functions (*e.g.*, Ramamurthy, Wilhemson, Pea, Gomez, & Edelson, 1995). However, different from the other systems, there is a mechanism (i.e., the four notetaking stages discussed above) in the present system designed to promote idea exchange among the members of a study group.

III. Students' Attitudes Toward the Type-C Notetaking Environment

A study was conducted to collect students' attitudes toward the system. The subjects of the study were 25 undergraduate students enrolled in the first author's Experimental Psychology class and 25 graduate students who had taken the course before. The subjects were divided into small groups, with 4 to 6 students in a group. The subjects of a group participated in the 1-hour research session together. A session started with a 15-minute illustration on how the system operates, followed by a 30-minute practice session. During the practice session, the subjects actually used computers to read the learning materials, create notes, and communicate with each other through the system. In the last 15 minutes of the hour, the subjects were asked to fill out a questionnaire.

In the questionnaire, the subjects provided their

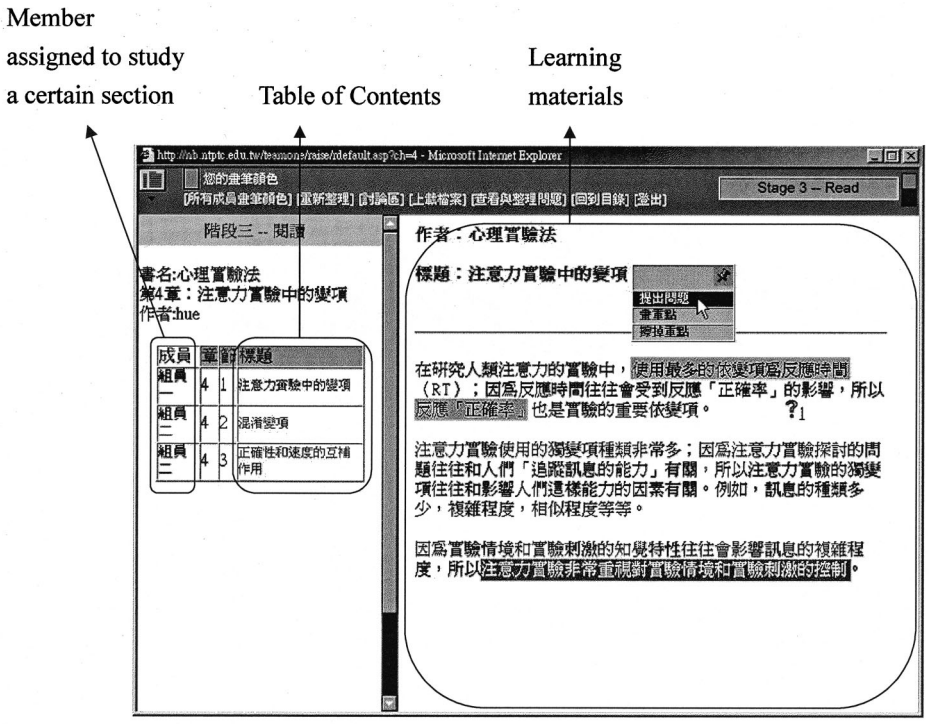

Fig. 2. A window (in the upper left corner) shows which notetaking stage a group is in, and a table shows which part of the materials a member is responsible to study.

personal demographic information, as well as information about their experience with and ability to use computers and the Internet, their studying habits (such as "whether or not they had participated in collective notetaking activities before?"), how well they could operate the system, and what they thought about the system. A summary of the results related to the subjects' ability to use computers, their studying habits, and their attitudes toward the system is presented below, and the details are listed in Appendixes 1 and 2.

(1) Among the subjects, 64% indicated that they used the Internet everyday to find and read information, and to send to or receive information from others. Sixteen percent of them used the Internet every other day, 14% did so once a week, and 3% once a month.
(2) On a 7-point scale, where1 represented "no anxiety" and 7 represented "high anxiety", 48% of the subjects responded with 1. Twenty percent of the subjects responded with 2, and 12% with 3.
(3) All the subjects indicated that they took notes of the materials when they were reading. However, 72% of them indicated that they took notes only when the reading materials were related to school work.
(4) More than 90% of the subjects indicated that they discussed the problems encountered during learning or issues related to school work with their fellow students. Seventy percent of them indicated that they frequently, at least once a week, discussed issues related to learning with a small group of people. However, 8% of the subjects never discussed learning issues with anyone.
(5) Eighty-four percent of the subjects agreed that the system could promote idea exchange among group members, and 82% believed that the system could enhance a learner's understanding of the learning materials. However, only 46% of the subjects thought that the system could cut down on study time.
(6) More than 80% of the subjects indicated that they would be willing to use the system to take collective notes if they were going to take notes, and 82% of the subjects indicated that they were willing to introduce the system to their friends as a means to study.

IV. Discussion

In the present research, a type-C or collaborative notetaking environment was created for an experimental psychology course. The note taking procedure of the system, which was modified from the procedures employed

in effective study programs, allows users to create collective study-notes and avoids the disadvantages associated with the type-D notetaking behavior. The questionnaire study results indicated that most of the subjects were used to using the Internet to locate information and to communicate with others, and that most of the subjects took notes while studying and discussed school work with their fellow students. The results of the study also indicated that the subjects agreed that the system was useful for promoting personal learning and interaction (and idea exchange) between group members. Thus, from the results, it is reasonable to assume that students are likely to accept the system as a means of studying and exchanging ideas with their fellow students.

Interestingly, although most of the subjects agreed that the system could promote learning, less than half of them agreed that the system could ease their study efforts, especially their study time. This could be because the system requires users to ask questions and to discuss them with others while taking notes, and because in the Chinese culture students are not used to raising questions even if they do not understand the materials they are studying. However, it is expected that this situation will change in a few years when the system is actually implement in the class. Then, "questions" and "discussions" from actual users will be collected and provided for future users as examples.

It is worth mentioning that the Type-C Notetaking System designed in the presented research can be easily modified by adding some components or by modifying the system regulations to create systems suitable for other types of learning environments. For example, the "assignment" regulation can be changed so that all the members need to study all the materials, and each member can assume a different role in the learning team; *e.g.*, one may be in charge of summarizing the materials, another may play the role of a critic evaluating the summaries, and still another may be responsible for locating and providing information relevant to the materials being studied. These modifications will allow the present system to create an environment suitable for cooperative learning. Also, because the entire study portfolio of a student is stored in the system, we can add an "evaluation" component to the system and implement a Web-based peer assessment program (Ma & Ng, 2002). A student's performance can be reviewed by other students, based on the complete set of records of that student's learning history, including how many times the student had logged onto the system, what s/he had read and how long s/he had read it, whether s/he had asked questions and if so what questions s/he had asked, whether s/he had provided summaries or comments and if so what s/he had provided. Viewing another student's learning history could provide a good opportunity for someone to reflect on his/her own learning.

To summarize the research reported in the present article, a system for a type-C notetaking environment was designed, that retains the advantages and avoids the disadvantages of the type-D notetaking method, which is a popular study method used by college students in Taiwan. It is also noted that the system designed in the present research can be easily modified to facilitate other types of learning activities, and that some of these learning programs are currently being studied in our lab.

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References

Johnson, D., & Johnson, R. (1999). *Learning together and alone: cooperative, competitive, and individualistic learning.* Boston: Allyn and Bacon.

Kagan, S. (1993). The Structural Approach to Cooperative Learning. In: D.D. Holt (Ed.), *Cooperative learning: A response to linguistic and cultural diversity* (pp. 9-19). McHenry, IL.: Delta Systems and Center for Applied Linguistics.

Kiewra, K. (1985). Learning from a lecture: An investigation of notetaking, review, and attendance at a lecture. *Human Learning*, **4**, 73-77.

Ma, A. W. W., & Ng, E. M. W. (2002). Designing an electronic assessment to foster peer learning. In: Kinshuk, R. Lewis, K. Akahori, R. Kemp, T. Okamoto, L. Henderson, & C.H. Lee (Eds.), *Proceedings of the international conference on computers in education*. Los Alamitos, CA: IEEE, Computer Society.

Pan, S. C. (1993). Studying notes' functions in learning. *Student Counseling Report*, **27**, 99.

Ramamurthy, M. K., Wilhemson, R. B., Pea, R. D., Gomez, L. M., & Edelson, D. C. (1995). CoVis: A national science education collaboratory. *Proceedings of the American Meteorological Society 4th Conference on Education Joint with the 11th Conference on Interactive Information and Processing System for Meteorology, Oceanography, and Hydrology*, Dallas, TX, U.S.A.

Robinson, F. P. (1970). *Effective study*. New York: Harper and Row.

Shepherd, J. F. (1992). *R.S.V.P.* (5th ed.). Boston, MA: Houghton Mifflin Company.

Slavin, R. E. (1983b). When does cooperative learning increase student achievement. *Psychological Bulletin*, **94**, 429-445.

Stahl, R. J. (1994). The essential elements of cooperative learning in the classroom. *The Social Educator*, **12**, 41-43.

Appendix 1
A summary of the Subjects' Experience with Using Computers and Notetaking

1. A Summary of the Subjects' Experience with Using Computers.

(1) Access the Internet through high bandwidth channels: Seventy-

two percent of the subjects could access the Internet through Asymmetric Digital Subscriber Line (ADSL) or cable.
(2) On a 7-point scale, the mean and standard deviation of the satisfactory rating of the speed of communications on the Internet were 4.78 and 1.33, respectively.
(3) Ninety percent of the subjects had used Microsoft Internet Explorer as a browser.
(4) Sixty-four percent of the subjects used the Internet to fetch information everyday, 16% of the subjects connected to the Internet once every 2 to 3 days, and 14% of them accessed the Internet once a week.
(5) On a 7-point scale, 10% of the subjects responded with 6 or 7 (representing high anxiety) to the item concerning their anxiety level when using computers, and 68% of them responded with 1 or 2 (representing high anxiety). The mean and standard deviation of the subjects' responses to this item were 2.30 and 1.72, respectively.

2. A summary of Subjects' Note Taking Experience

(1) All the subjects indicated that they had the habit of taking notes while reading. Twenty-six percent of them indicated that they took notes whenever they read, and the rest of the subjects indicated that they took notes only when they read textbooks.
(2) Two percent of the subjects indicated that they discussed with their friends everyday the problems they encountered during learning or issues related to school work, 18% of the subjects indicated that they discussed these issues with their friends once every 2 to 3 days, and 50% of them indicated that they discussed these issues with their friend at least once a week. However, 8 percent of the subjects indicated that they never discussed their learning problems or school work with anyone.

Appendix 2
The Questionnaire Used in the Present Study to Collect Students' Attitudes Toward the Collaborative Notetaking System.

Note 1. Except for the open-ended question listed at the end of the questionnaire, the students responded to all the questions by indicating their attitude on a 7-point scale, where 1 represented a negative attitude (*e.g.*, do not agree, do not understand, etc.) and 7 represented a positive attitude (e.g., agree, understand, etc.).
Note 2. The numbers in parentheses listed at the end of each question are the mean and standard deviation (SD) of subjects' ratings. The first is the mean, and the second is the SD.

(1) Please indicate how well that you understand the way the system operates.

a. How well do you understand the operations involved in the "Preview and Questioning" stage? (6.08, 0.97)
b. How well do you understand the operations involved in the "Assignment" stage? (5.84, 1.13)
c. How well do you understand the operations involved in the "Read" stage? (5.7, 1.11)
d. How well do you understand the operations involved in the "Discussion and Integration" stage? (5.12, 1.38)
e. How well do you understand the operations involved in using the "Forum"? (6.44, 0.84)
f. How well can you use the "highlight" function? (6.76, 0.59)
g. How well can you use the "sticker" function? (6.50, 0.68)
h. How well can you use the "hyperlink" function? (5.96, 1.46)
i. How well can you use the "download and unload" function? (5.62, 1.31)

(2) Please indicate how much the following functions can help you in learning the materials. (Note: the numbers listed in each square of the table represent the mean and SD of the students' ratings.)

	Find Important Information	Memorize Information	Integrate Information	Understand the Information	Supplement Information not contained in the Materials	Promote group interaction and knowledge sharing
Highlight	5.65, 0.71	5.42, 1.31	4.08, 1.60	5.42, 1.31	3.32, 1.89	5.28, 1.51
Sticker (note taking)	5.50, 1.37	5.18, 1.37	4.54, 1.59	5.70, 0.95	5.26, 1.40	5.90, 1.25
Forum	4.52, 1.57	4.10, 1.79	4.78, 1.52	5.28, 1.41	5.38, 1.31	6.46, 0.86
Hyperlink	4.06, 1.51	3.84, 1.67	4.52, 1.57	4.88, 1.51	6.02, 1.19	5.50, 1.49
Download and Upload Materials	3.72, 1.73	3.60, 1.64	4.38, 1.63	4.74, 1.58	5.66, 1.51	5.74, 1.37
Preview and Questioning	5.48, 1.27	4.62, 1.70	4.28, 1.81	5.48, 1.28	4.40, 1.47	5.42, 1.23
Assignment	2.96, 1.0	2.66, 1.61	3.40, 1.58	3.56, 1.85	3.22, 1.71	4.80, 1.81
Read	5.58, 0.95	5.34, 1.14	5.51, 1.07	5.88, 0.85	5.66, 1.00	6.00, 1.21
Discussion and Integration	5.50, 1.33	5.52, 1.41	6.16, 1.02	5.96, 0.92	5.68, 1.28	6.20, 0.99

(3) Please indicate how well that you agree with the following statements.

a. Using the system makes learning effective. (5.52, 1.33)
b. Using the system helps me to gain good marks. (4.82, 1.34)
c. Using the system saves study time. (4.40, 1.53)
d. Using the system promotes group interaction. (5.76, 1.20)

(4) Please indicate the degree of your willingness to use the system to conduct the following activities.

a. In addition to interacting with your fellow students through the telephone, mail and face-to-face interaction, I will use the system to communicate with them. (5.50, 1.25)
b. If I am going to take collective learning notes, I will use the system to take them. (5.72, 1.41)
c. I will recommend the system to my friends to assist them in learning. (5.84, 1.27)

促進合作學習的網路共筆系統

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摘　要

當選修課業繁重的課程時，「共筆」是臺灣大學生常常採用的一種學習策略。雖然「共筆」具有「合作學習」的特色，但是學生常使用類似「分工合作」的「共筆」方式（一個人只負責一小部分學習材料的學習），所以在「共筆」活動的過程中學習小組的成員之間少有互動，以致現有的「共筆」方式除了能夠節省參與活動的成員的學習時間外，並不能保證共同筆記的品質，甚至可能會對「學習」產生負面的影響。本研究設計了一個能夠在網路環境中運作的共筆系統；這個系統根據「有效學習」的學習流程，設計了一套「共筆流程」。使用本系統的學生需要經過以下的程序來製作「共同筆記」：(一)略讀提問，(二)學習材料分工，(三)閱讀答問，以及(四)討論彙整。因爲通過這些程序，學生會(一)對學習材料的結構與內容形成完整的印象，(二)以主動閱讀的方式在材料中找問題的答案，並需要(三)在每一個過程中進行討論，所以研究者認爲這個系統能夠克服「共筆」的缺點。目前這套系統已經運用在一門「心理學實驗法」的課程中，研究者並以問卷收集了 50 位學生對這個系統的使用態度。研究結果顯示，學生雖然不認爲這套系統能夠節省他們的學習時間，但是他們普遍的認爲這套系統能夠提升他們的學習成效，並願意實用這套系統學習。