

*Collaborative learning refers to an instruction method which requires students to work together in small groups toward a common goal. In this issue of CDTL Brief, glean from the authors' experience with Collaborative Learning and discover how it can be used to promote meaningful learning among university students.*

## Using Online Forums as a Replacement for Face-to-Face Discussion Groups<sup>\*</sup>

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### Introduction

The development of technology introduces the possibility of using online discussion forums as part of the formal structure of modules. Traditionally at NUS, lectures for a module have been supplemented with face-to-face discussion groups, which over the years have increased dramatically in size. Not only do such groups require rooms to meet, they also absorb considerable amounts of the tutors' (who are often also lecturers for the module) time. Since online discussions are not constrained to a specific place or time, using such discussion forums could potentially free up valuable resources such as staff time, physical space and maximise convenience for students and tutors. However, questions remain about the effectiveness of online discussions for stimulating learning and their acceptability to students and staff as a substitute for face-to-face discussions.

Bearing these questions and possibilities in mind, a trial on using online discussions conducted through the Integrated Virtual Learning Environment (IVLE) as a replacement for face-to-face discussion groups in a 3000-level Psychology module was undertaken with technical assistance of staff from the Centre for Instruction Technology. This paper describes the methodology, results and the conclusions drawn from the trial.

### Methods

#### *Structuring of online discussions*

The trial of online discussion forums was conducted

on 142 students taking the module, PL3212Y "Health Psychology" during Semester Two (Academic Year 2002/2003). As there were deadlines for papers and time required to introduce the online discussion forums to the students, we decided to have nine 1-week discussions on nine different topics on health psychology. These discussions were synchronised with topic coverage in the module syllabus. Students were randomly assigned to 14 9-person and two 8-person groups. Each member within the 9-person group assumed leadership of the discussion for one topic. After each member of the 8-person groups had led one discussion, the members were reassigned to other groups for the final discussion.

The discussions were conducted asynchronously over 1-week beginning at 12.00 am Monday and ending at 11.59 pm the following Sunday. During this time students could make postings whenever they had access to the Internet. Group leaders were tasked to get the discussions started and keep them on track. As lecturer of the module, George Bishop monitored the discussions but did not take part in them. In most cases groups began their discussions early in the week. However, when a group did not start their discussion by mid-week, an email was sent to all members of that group urging them to commence their discussion promptly.

<sup>\*</sup> This article is condensed and adapted from the original article, 'Using Online Forums as a Replacement for Face-to-Face Discussion Groups' in *Proceedings of the FASS—CDTL Symposium: Grounded Experiences in University Teaching and Learning*. National University of Singapore.

Following each week's discussion, group leaders for that week were to write a 10-page 'position paper' which accounted for 25% of the overall module grade. Group leaders were told that while their paper should reflect the group's discussion, they need not be limited to points raised or materials utilised in the discussion. An exemplar position paper was made available on the module website for students to consult.

Position papers were submitted via the IVLE and were due one week after the specific discussion had closed. To give students practice in critically evaluating ideas developed in response to the questions posed in the discussion topics, each position paper was anonymised and sent to a randomly selected student in the class for critique. Students were to write a 5-page narrative critique of the position paper but not to grade the paper. Critiques were due one week after the student received the position paper. Each student did one critique that constituted 15% of the overall module grade.

To encourage quality contributions to online discussions, discussion leaders were required to rate the quality of the contribution of each member of their group (excluding themselves) at the close of the discussion on a topic. Thus each student received eight ratings on the quality of their contributions to the different discussions. In conjunction with the percentage of discussions in which each student participated during the term, these ratings provided the basis for assigning marks for discussion participation, which constituted 10% of the overall module grade. Thus, in total, participation in the discussion forums, the position paper and critique made up 50% of the total module grade.

#### Online surveys

To assess students' response to the use of the online discussions, we conducted two online surveys: one following completion of four of the nine discussions and the other following completion of all discussions. In these voluntary and anonymous surveys, students used a 5-point scale to rate the following:

- Experience with online discussions
- Quality of the online discussions
- Quality of the online discussions versus face-to-face discussions
- Amount of learning from the online discussions
- Discussion format that best stimulates learning
- Preferred format of discussion

In addition, students were asked to list three things they liked about the online discussions and three things they disliked. In all 98 students responded to the mid-term survey and 91 students responded to the end-of-term survey.

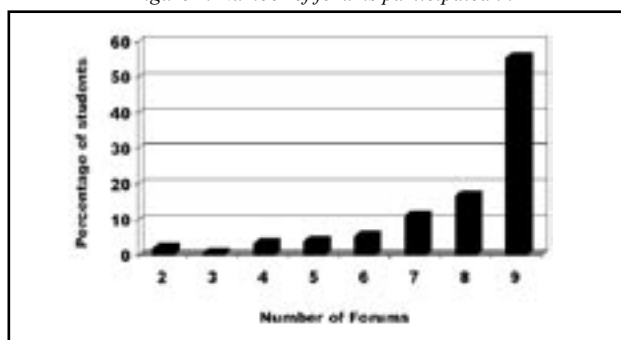
## Results

The online discussions were evaluated in terms of participation rates, observation of the discussions, position papers and critiques produced, as well as responses to the online surveys.

#### Participation rates

Overall, participation in the online discussions appeared to be high. Across all discussions, the participation rate was 87.9% with a total of 3937 postings (i.e. average 27.7 postings per student). The total number of postings by individual students ranged from 3 to 87 over the course of the term. In Figure 1, 56% of the students participated in all nine discussions, 17% participated in eight discussions and 11% participated in seven. 16% of students participated in six or fewer discussions.

Figure 1: Number of forums participated in



Despite some fluctuations, the rate of postings was relatively even across most days with the highest numbers recorded on Thursday and Sunday (Figure 2). Such a trend could be due to the Wednesday lectures and students posting to make their participation count before the discussions close at 11.59 pm on Sunday.

Figure 2: Postings by day of week

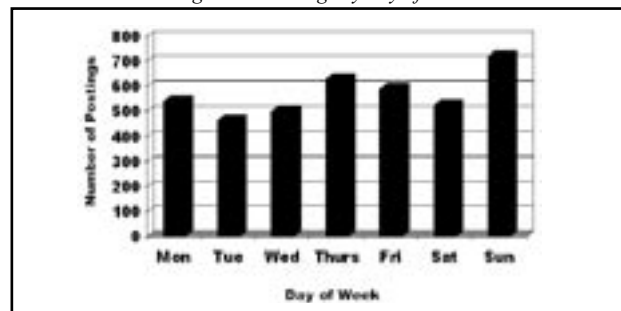
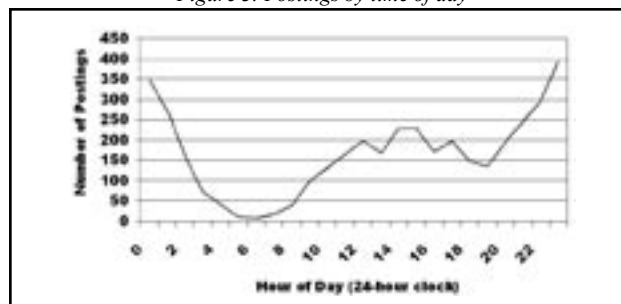


Figure 3 indicates that postings were made around the clock with the rate of postings peaking around midnight and falling to their lowest levels at about 6 am.

Figure 3: Postings by time of day



*Observations of discussions, position papers and critiques*

Impressions from reading through a convenience sample of the discussions captured in IVLE suggested that the students took the assignment seriously and the discussions appeared reasonably well focused with little chit-chat or other off-topic discussion. Also it appeared that the quality of materials discussed was high—students made appropriate references to assigned reading materials and brought in suitable materials from news media, professional publications and Internet resources. In several instances students summarised readings, both assigned and unassigned, and posted articles from the Internet for other group members to read.

On the whole, the quality of the position papers and critiques was what one could expect from students in a 3000-level module. The papers of course differed in quality but most addressed pertinent issues related to the discussion questions credibly. Though the students were uncertain about the critiques they were to do, they generally did reasonably well in evaluating the position papers assigned to them.

*Online survey responses*

The two online surveys produced very similar patterns of response. In the interest of efficiency only results from the second survey will be reported. Results for the questions using a 5-point scale are found in Figures 4 through 9. As will be noted, 69% of the respondents rated their experience with the online discussions as good or very good (Figure 4). Similarly, 61% assessed the quality of online discussions as good or very good (Figure 5). 56% indicated that the quality of online discussions was superior to what they encountered in face-to-face discussion while 32% thought face-to-face discussions were better (Figure 6). 88% of the respondents indicated that they had learned at least a moderate amount from the online discussions (Figure 7). 51% indicated online discussions were better at stimulating learning, 37% viewed face-to-face discussions as better and 12% stated that the two formats were equal in this regard (Figure 8). Finally, 57% preferred the online discussion format with 31% preferring face-to-face discussions and 12% indicating equal preference (Figure 9).

Figure 4: Ratings of experience with IVLE discussions

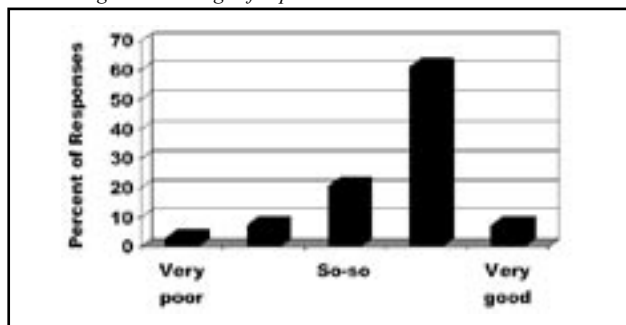


Figure 5: Ratings of quality of IVLE discussions

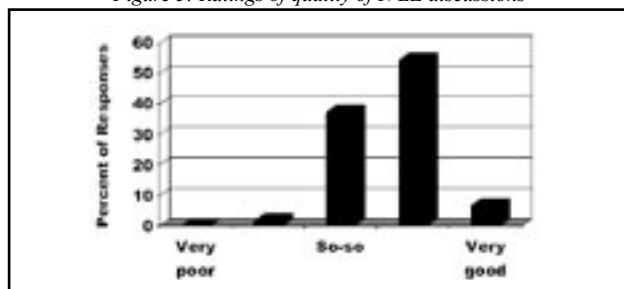


Figure 6: Comparison of quality of face-to-face to IVLE discussions

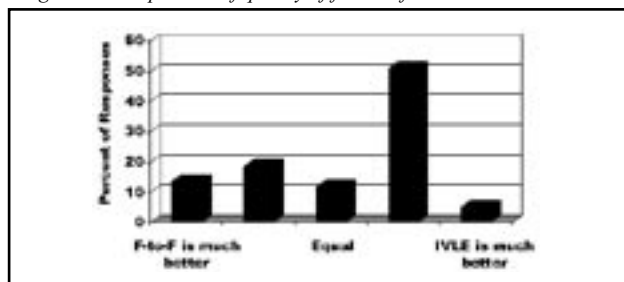


Figure 7: Ratings of amount learned from IVLE discussions

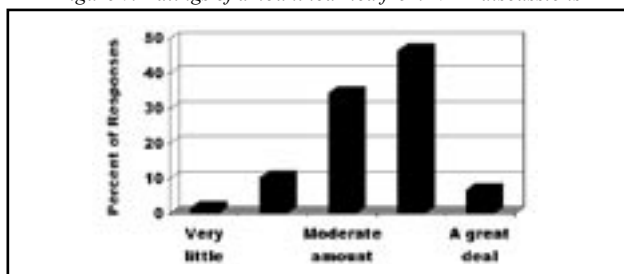


Figure 8: Comparison of face-to-face to IVLE discussions with respect to stimulation of learning

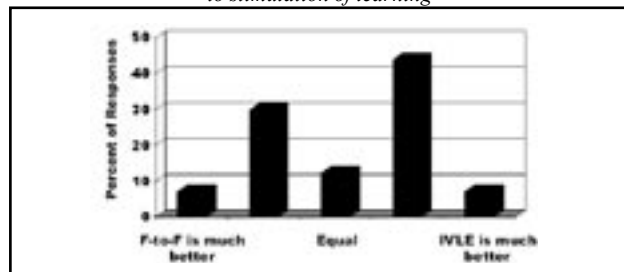
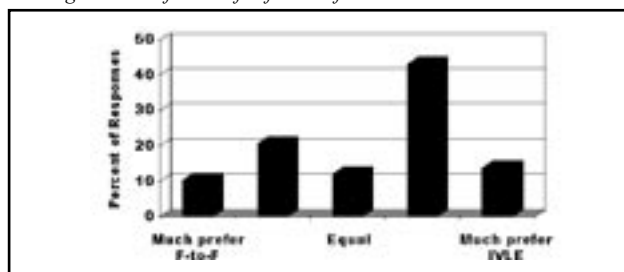


Figure 9: Preference for face-to-face versus IVLE discussions



When asked what they liked and disliked, 67% & 31.9% of the students mentioned the flexibility and convenience, respectively, of the online discussions as features they particularly liked. With regard to features that students disliked, the specific aspects that received the most comments were the impersonal discussion sessions

(34.1%) and the lack of instructor participation (22%). One student commented that the latter aspect 'makes us feel like sheep without a shepherd'.

### Conclusions

On the whole, we judge this experiment in the use of online discussions to be highly successful and believe that such discussions can be a viable alternative to face-to-face discussion groups. Participation in the discussions was high and the quality of the discussions also appeared to be favourable with a relative minimum of chit-chat and off-topic conversation. Data from the online discussions also pointed towards the usefulness of this format.

The scope of materials employed in the online discussions was noticeably greater compared with the variety generally turned to in face-to-face discussions. This can certainly be attributed to the fact that the discussions were conducted asynchronously over the course of a week, thereby providing students with opportunities to seek out materials to address issues raised in the discussion interactively.

The surveys indicated that this format is highly acceptable to students and, in fact, preferred by a majority. Students rated their experience with the online discussions positively, regarded the discussions as high quality and indicated that they had learned from them. When asked to compare the quality of online discussions with that in face-to-face discussions, students generally rated the quality of online discussions as better. Convenience and flexibility were among the key reasons for favouring online discussions.

However, online discussions are not without their drawbacks. Students commented that they missed the social interaction of face-to-face discussions. One possible solution is to schedule face-to-face meetings for members of the discussion groups so that they can get to know each other and thus be able to associate names on the screen with real individuals.

Another aspect viewed negatively was the lack of instructor involvement in the discussions. In this case the lack of instructor intervention was by pedagogical design. One purpose of the discussions was to get students to examine issues on their own and without being 'spoon-fed'. Even though students expressed concerns about getting off-track in their discussions, the ability to self-correct when they go off-track is an important aspect of learning. In our view, it is important for students to realise that they are not 'sheep' and the instructor is not a 'shepherd' in the learning process. Rather, students should be independent learners with the capacity to self-correct. Further, the instructor was either available in person or via email whenever students had questions. To address this concern in future use of such forums, we are explicitly telling students that the instructor will monitor the discussions but not participate and the reasons for this. Also, students will be encouraged to bring up concerns with the instructor either in person or through e-mail.

For those considering using online discussions, structuring the discussions is critical. In particular, we would argue that the following principles are required for online discussions to be successful:

- The goals of the discussion be explicit and clear,
- The topics of the discussion need to be well defined and circumscribed,
- There needs to be clearly stated leadership for the discussions, and
- Participation in the discussions should have clear relevance to grades.

At this point, we cannot say with certainty that these are iron-clad requirements, but we can say that online discussions of the type described in this paper, which included these elements, were successful. ■

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# Weekly Review and Integration of Ideas and Abilities

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Students are constantly bombarded in classrooms, textbooks and on the Web, with fragments of information, conclusions, beliefs and opinions. An important ingredient of becoming educated is the ability to figure out for oneself which of these assertions to accept as true or credible, and which ones to reject.

Another important ingredient of 'educatedness' is the ability to convert the fragments into a coherent, integrated system of knowledge. Only with such integration does the mind learn and grow. Without the integration, information crowds and clutters the mind. For such integration to happen, however, one must be

able to first distinguish those fragments that might qualify as knowledge, from those that would count as trivia.<sup>1</sup> Students who don't make the distinction learn words and sentences as answers to questions, without any transformation or reorganisation of their internal knowledge system. They also end up with logically inconsistent beliefs without awareness of the inconsistencies. The 'fragmentedness' can also hamper their ability to transfer ideas and abilities across domains.

One way to consolidate what a student learns in a module and connect it to what she has already learned, both within the module and elsewhere, is to have an obligatory weekly review exercise involving individual as well as collective effort—a strategy I have found useful in my modules. Each week, within three days of a class session (or lecture), students are expected to think about what they learnt in the session, in terms of both knowledge and abilities. They pool their thoughts together at an 'affinity group' meeting, and send me the collective 'review and integration' (one submission per affinity group).<sup>2</sup> The 'scribe', one member representing the group, writes and submits the weekly review by e-mail, with a copy to the other members. Once all the submissions come in, I put together a consolidated version, with any additional comments I might have, and make it available to the class.

Students get a template for organising the review: the Obligatory Weekly Review and Integration (OWRION) [auriðn] as we call it. The core template, modifiable to suit the level of the class and its needs, is as follows:

<p>Name of the Affinity Group  Names of participating members  Name of Scribe</p> <ol style="list-style-type: none"> <li>1) Lesson: concepts, statements, abilities, (e.g. central theme(s), special learning points, connections, things to think about).</li> <li>2) Handouts: (i) relevant for the class; (ii) distributed in the class/posted on IVLE.</li> <li>3) Homework: readings, affinity group exercises, quizzes.</li> <li>4) Highlights: anything you found particularly interesting or exciting (e.g. an idea, a piece of data, or the structure of an argument that you found striking, or any new insights you had).</li> <li>5) Any idea that you felt should be pursued further in class.</li> <li>6) Anything that needed clarification, any disagreements, other problems, suggestions.</li> </ol>
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While the weekly review is expected to be a product of group discussion, students can include individual questions or disagreements within the group. Members of the group are required to take turns being the scribe,

so that in addition to their regular assignments, I see at least two short pieces of ungraded work by each student in the class during the semester.

Such weekly reviews serve several functions. For the students, at the end of the semester, the points under (1) compiled from all the weekly reviews results in a picture of what they should know and be able to do as a result of having taken the module. Item (2) ensures that they have a list of all the handouts, readings, exercises and assessment tasks in the module. Item (3) helps to keep track of what they need to do each week (tests, assignments, readings and such). Together, items (1)–(3) help the students, particularly those less organised, keep abreast of the class.

Item (4) of the review gets students into the habit of active listening in class, paying attention to important points and noticing special highlights. (5) provides them the opportunity to contribute to the direction of the class, and make it relevant for themselves. Item (6) allows difficulties to be sorted out as and when they occur, rather than leaving them to the end of the semester. In sum, the review forces students to think about their own understanding of the issues dealt with in the classroom, readings and exercises, integrating the different parts, and to identify gaps and misunderstandings that need to be remedied.

The weekly reviews serve an important function for the teacher as well. (1) provides feedback on whether the students have perceived the teacher's priorities, separating the central ideas from the peripheral, with a sense of relevance to the rest of the module. (2) and (3) serve as a reminder to the teacher of the various deadlines. Item (4) gives the teacher an idea of what interests students, and an insight into the nature of the student cohort. (5) and (6) provide timely feedback on what the students have learnt, and what needs clarification or intervention.

Being a group exercise in the context of a module where inquiry-based classroom activities involving constant student participation replace lectures, the weekly discussions and reviews carry additional benefits. Genuine, engaged discussion, anchored as far as possible in empirical grounds and rational argumentation, can stimulate deeper learning, depending on the group

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1. The inability to distinguish knowledge from trivia is reinforced by TV shows that equate intelligence with the ability to access trivial fragmented pieces of information, such as *How to be a Millionaire* and *Singapore's Brainiest Kid*.
  2. For a discussion of the strategy of affinity groups, see Mohanan, T. (2003). 'Affinity Groups: The Idea and Its Potential' in *Ideas on Teaching*. Vol. 1, pp. 14–15. Centre for Development of Teaching and Learning, National University of Singapore.

dynamics. The result of such collaboration is often more than the sum of the individual inputs. The exercise also gives members of each group a structured forum for articulating ideas, formulating conclusions and refining statements collectively.

The weekly review exercise has mostly drawn positive reactions from students in my modules. One mild objection has had to do with pressures of time, which defeat the very purpose of the reviews. Each review

is essentially the work of the scribe rather than that of the group, though sometimes with input from other members. The net result is a higher workload for teacher and students, without substantial benefits. To reduce the burden on both the teacher and the students, I have sometimes found it necessary to trim the review down to items (5) and (6). Nevertheless, having used the strategy now for over two years, I believe that retaining some version of the OWRION is still worthwhile and rewarding for both the teacher and the student. ■

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# Collaborative Learning: Some Issues and Recommendations

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Collaborative learning has a long history in Educational Psychology and is increasingly being employed in a variety of contexts at NUS. Given this rising interest, we have decided to explore a few selected, central issues involved in such approaches. First, we should exactly and simply define what we mean by 'collaborative learning'. While collaborative learning necessarily takes place in an interactive and interpersonal environment, mere interaction and the presence of others does not automatically mean that collaborative learning is occurring. To be considered collaborative learning, these interpersonal interactions must include the sharing of information, meanings and understandings in such a way that all parties educationally benefit from the interaction and come to a broader and more integrated understanding of the material. According to research, collaborative teams achieve higher levels of thought and critical thinking and retain information longer than students who work as individuals (Gokhale, 1995).

While these types of interactions may occur informally among students, we shall focus on those activities that a professor can structure and initiate. Specifically, we will examine group projects as a potential context where collaborative learning can thrive. This potential can probably only be fully realised through some planning and monitoring by the professor, as groups can drift into counter-productive habits without such. For space reasons, we will focus on two issues: (1) formation of groups, and (2) setting the assignment for integration.

## Formation of Groups

Oftentimes, for convenience, we allow students to form their own groups. However, under many circumstances, it may be useful to intentionally assign students of various performance levels, backgrounds and strengths to each group. To promote content learning, it would be useful to form groups that have variance in terms of aspects like seniority, abilities and discipline expertise. In this scheme, students can benefit from having a combination of more- and less-expert members with different styles of analysing and comprehending a problem. The more-expert and senior students gain deeper appreciation of the material as they help others understand it, while the more novice students can often learn a lot from someone closer to their point of development (e.g. a more expert peer) in ways that may be hard to learn from an expert (e.g. the professor).

In addition, it may be useful to form groups based upon a combination of subject expertise: either discipline/major or varying abilities within a major (e.g. some students are more maths-oriented, while others may be better at the conceptual work). Collaborative learning is promoted by such utilisation of varying expertise within a particular group, as everyone can play an active role in such groupings. Some of these grouping suggestions depend in part on knowing your students. However, in cases when knowing the students is difficult (e.g. large classes needing to form groups early in term), then one

can often approximate things by using variables such as year and major as ways to ensure some diversity of abilities and expertise in the groups.

There may be other qualities that one may use to arrange diversity among students to ensure smoother group processes. Student personality may be such a variable. For example, grouping a shy student with an intelligent, yet patient student can be the impetus for that shy student to become more active. In addition, an appropriately assertive student can be the perfect balance to an aggressive student or a remedy for students who wish to passively feed off the group by doing little work. Finally, gender may be a consideration in forming groups. Females in groups dominated by males can often be more passive than if they were in more evenly split groups or in all female groups. Ensuring a more balanced gender composition (even if it is not 50–50) would be a simple and easy remedy. We would not recommend all male/all female groupings, as this would likely exasperate this phenomenon in the future student and working lives of our students.

### **Promoting Integration of Group Work**

*Setting the Assignment.* One of the biggest reasons that much group work is not collaborative learning is that students tend to do group work independently—often being quite unaware of what the other members have done—and at the last minute ‘throw’ together all the pieces to assemble the ‘group project’.

One way to promote more integration (and learning!) among members is to structure the assignment in a ‘jigsaw’ where each part is truly interdependent and each part must be done and known to all members for the project to work at all (Peterson, 2001). This type of interdependence of the content helps the group function in a more integrative manner, thus promoting broader content learning—the main educational goal of group work. If the group work is not integrative, then it is merely just individuals working on their own and using groups is neither efficient nor educational in such cases.

*Assessment.* The final assessment of the group work is another vehicle for promoting integration. We briefly

consider group presentations. One easy way to promote integration in this situation is to question students on parts completed by other students. Alternatively, a student may be requested to present the parts completed by others. For this strategy to be optimal, one should avoid surface questions and superficial presentation of other’s material. Instead, deeper understandings about connections among the parts of the report should be demonstrated by the students to gain good marks.

In summary, collaborative learning is an effective instruction method for teaching university students. In particular, when applied to its fullest, collaborative learning can help students learn the material more deeply by interacting with peers who have different strengths, perspectives and knowledge. Such interactions promote a more integrated understanding of course content through the individual connecting the pieces of knowledge together. However, such thought processes do not often occur naturally, and a well-set structure (e.g. setting an assignment that promotes such interactions and explicating to the students that these integrative outcomes are necessary for high marks) by the instructor can be crucial in promoting these interactive processes.

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### **Recommended Reading**

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# The Impact of Teaching Assistants on Students' Learning Experience: A Study on Teaching and Learning in an NUS Chemistry Laboratory

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## Teaching Assistants (TAs) in the Laboratory

It is no secret that effective teachers can make a significant impact on the students' learning experience. The Department of Chemistry in NUS deploys postgraduate students as Teaching Assistants (TAs). These TAs are largely 'laboratory demonstrators', who assist the academic staff in demonstrating laboratory techniques to undergraduate students during practical (laboratory) classes. Conversely, it has been observed in NUS, and reported widely in chemistry education literature, that when students perform chemistry experiments, they often focus too narrowly on the manipulative tasks at hand and do not give much thought to the principles behind the experiments. As a result, students understand and learn very little from the laboratory classes. In this paper, we will describe a study conducted to improve the students' learning experience in laboratory classes involving TAs. Other useful findings from the study will also be discussed.

## A Quasi-experimental Action Research Study

CM1121, "Basic Organic Chemistry", is an essential module offered to students from Chemistry, Life Sciences, Engineering and various other majors in both semesters of the Academic Year. Students complete laboratory tasks such as synthesising compounds, separating mixtures and identifying the functional groups in known and unknown compounds during the 15 hours of required practical work.

In Semester 1 (Academic Year 2003/2004), 554 students (mainly Life Sciences students) enrolled in CM1121. This paper describes a quasi-experimental action research study carried out on 79 students of which 37 were assigned to the Experimental group and 42 to the Control group. These students had obtained similar 'A'-level (or equivalent) results in Chemistry. Students in the Experimental group received 'intervention' (as described in the next section, 'Improving Students' Laboratory Experience') during their laboratory sessions, but those in the Control group had their laboratory sessions conducted in the traditional manner (i.e. no 'intervention'). Two consecutive tests were designed and administered to measure the students' knowledge of the experiments

and their understanding of the principles behind the experiments towards the end of the semester. A survey questionnaire was also administered to assess their learning experience in the laboratory. Finally, follow-up interviews were conducted with some students in the experimental group to collect qualitative information.

Table 1 shows a brief summary of the activities that took place over the five CM1121 laboratory sessions:

Table 1: CM1121—Activities of the five laboratory sessions

Session 1	Session 2	Session 3	Session 4	Session 5
Experiment 1	Experiment 2 (Part One)	Experiment 2 (Part Two) <i>Test 1</i> (covering Experiment 1)	Experiment 3 (Part One)* <i>Test 2</i> (covering the entire Experiment 2) and Survey	Experiment 3 (Part Two)*

\*Experiment 3 was not included as part of this study, due to deadlines for completing the Honours Year project.

## Improving Students' Laboratory Experience

For students in the Experimental group (taught by the first author), each laboratory session was generally conducted as such:

- Worksheets were only distributed to the students before a session began. These worksheets were uniquely designed to present vital aspects of a new experiment in a way that related the experiment to what the students had learnt before so that they could better integrate the new information into their existing knowledge networks. In addition to using diagrams to illustrate abstract concepts, a number of thought-provoking questions were included to encourage the students to think. Although the first author provided some answers, students answered most of the questions after discussing among themselves.
- A laboratory instructor (i.e. academic staff) would begin a laboratory session with a standard pre-laboratory briefing for students from both the Experimental and Control groups. Then, students

\* The study reported in this article is based on an Honours Year project in Chemistry completed recently by Lau Wan Yung. He was serving as a Teaching Assistant for the module CM1121, "Basic Organic Chemistry" while conducting this study.

in the Experimental group, who had received the worksheets prior to the briefing, would be taken aside by the first author for a preliminary discussion of the worksheet. These students would then pair off to perform the experiment. A discussion would be held at the end of the experiment where students would share their answers to the questions on the worksheet.

- As an additional effort to stimulate thinking, the pairs of students were told to vary the value for one of the variables in the experiment so that they could witness collectively, how the variable affects the results.

## Results

### Quantitative results

Statistical significance at the 0.01 level was obtained in analysing the students' test scores using the two-tailed independent *t*-test.

Table 2: Analysis of Students' Scores on Test 1

Group	N	Mean Score	<i>t</i>	<i>p</i>
Experimental	37	18.7	2.84	0.006
Control	42	14.5		

Note: The maximum possible score for Test 1 is 30.

Table 3: Analysis of Students' Scores on Test 2

Group	N	Mean Score	<i>t</i>	<i>p</i>
Experimental	37	70.5	3.48	0.001
Control	42	61.7		

Note: The maximum possible score for Test 2 is 80.

### Qualitative results

In the survey questionnaire, students were asked to rate some statements on a five-point scale. These statements can essentially be categorised according to three main issues:

- How well the students have understood the experiments.
- Their attitudes towards laboratory work (e.g. was it boring or difficult?).
- Their perceived ability in mastering laboratory techniques.

The responses of students from the Experimental group had more positive views on all three issues as compared to those from the Control group.

In addition, the interviews yielded the following information:

- Most students in the Experimental group exhibited a rather substantial understanding of the experiments based on the verbal explanations provided (upon request) for their answers to the test questions.
- Though some students answered the test questions incorrectly, this was largely due to false assumptions

or misconceptions, which were difficult to overcome within the short period of 'intervention'.

- The worksheets and the guidance from the first author had helped students to learn both the conceptual and technical aspects of the experiments.
- Varying the values of some variables in the experiments had made the laboratory sessions more interesting for the students as they could witness and discover new results instead of reproducing known data.

## Implications and Recommendations

### Role of TA in the laboratory

In this study, the first author succeeded in making a significant difference to both the students' academic achievements and their attitudes toward laboratory work by using various strategies to enhance their learning experience. It should be noted that any TA, whose commitment to teaching is similar to that established by the first author, can make an impact on the students' learning experience. This calls for possibly, the establishment of a set of selection criteria focusing on the teaching commitments of a TA (e.g. the minimum number of hours that a TA is required to teach, participation in a training programme that raises the TAs' awareness of their role in improving the students' learning experience, particularly in the laboratories).

### Management of learning activities

Literature on education states that careful organisation and sequencing of activities are essential in the facilitation of meaningful learning. In this study, the first author structured the information on the worksheets before presenting it to the students. Therefore, students could integrate the new knowledge with their existing knowledge better. In addition, it is important to reinforce the key concepts introduced in previous experiments by revisiting or representing these ideas in different contexts in subsequent experiments. The series of worksheets had this feature built-in.

Since there is a shift in emphasis from performing mechanical tasks to illustrating the principles behind the experiments to the students, we should perhaps adjust the time allocated for these activities accordingly. Though performing mechanical tasks is essential in developing the students' competency in laboratory techniques, these tasks could perhaps be done outside the formal laboratory hours so that more time could be devoted to what is important during the formal laboratory hours. Adopting an open laboratory policy where students can return to the laboratory to finish the mechanical tasks at their convenience is one possible solution.

## Conclusion

According to literature on science education, students' laboratory experiences should be pivotal to their learning of the subject because the laboratory is a place where the students learn how to 'do' science. However, many students' laboratory experiences do not include the part on doing 'real' science. In fact, laboratory work (especially in lower-level coursework) has been given a reduced emphasis. It appears that such could be the result of (at least on the students' part) a fear of performing dangerous acts in the laboratory due to insufficient experience and the lack of available guidance. With a good supply of

postgraduate students, who can be deployed as TAs (although careful selections must be made to ensure the quality of their service and to avoid derailing them from completing their postgraduate studies), and a carefully designed curriculum, the students' learning experience in the laboratory can be improved. ■

## Acknowledgments

*The authors would like to thank Dr Lam Yulin, Ms Wong Nguk Yeng and Ms Teh Yun Ling from the Department of Chemistry for their assistance and contributions.*

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# A Model of Collaborative Learning Project for Japanese University Students

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## Introduction

In Japan, the growing awareness that collaborative learning promotes critical thinking and helps students develop social skills (Johnson & Johnson, 1986) plus the reduction in class size due to Japan's declining birth-rate have spurred a handful of instructors at tertiary-level institutions to use the collaborative approach to learning. What the instructors are discovering, though, is that when students are required to work independently in small groups, they are usually at a loss as to how they should proceed. The reason is that most students have had no prior opportunity to direct their own learning, or even to work cooperatively. In the Foreign Language (FL) classroom, there is an additional problem. Students with limited conversational skills and/ or little confidence in using the target language have difficulties expressing themselves and organising their ideas in the FL. Therefore, in Japan and perhaps other Asian countries, effective and successful collaborative learning must initially include methods of helping students organise themselves, communicate with each other and (if desired) use the FL. The model presented in this paper incorporates these instructional elements.

The terms *cooperative learning* and *collaborative learning* are frequently used interchangeably. Indeed, the approaches do overlap, but there is a fundamental difference that is important to consider when identifying instructional outcomes and designing lesson plans and instructional materials. The collaborative approach is student-centred and the instructor is a facilitator.

According to Panitz (1997), "Collaborative learning is a personal philosophy, not just a classroom technique. In all situations where people come together in groups, it suggests a way of dealing with people, which respects and highlights individual group members' abilities and contributions. There is a sharing of authority and acceptance of responsibility among group members for the group's actions." The cooperative approach is a structured form of collaboration. "Cooperative learning is defined by a set of processes which help people interact together in order to accomplish a specific goal or develop an end product which is usually content specific. It is more directive than a collaborative system of governance and is closely controlled by the teacher." (Panitz, 1997).

## Instructional Process

A 6-week, out-of-class collaborative research project was designed for second-year Japanese university Engineering students studying English as a Foreign Language (EFL). They were required to find, organise, and then display their data in a cohesive group PowerPoint (PPT) presentation. As genuine collaboration was an important aim of the assignment, the use of English for group discussions was encouraged, but not required. However, all presentations had to be given in English, without using notes. This was the students' first experience in both independent research and collaborative learning, so they were guided through both processes by using specific cooperative activities prepared by the instructor and assignment deadlines.

## Goals

Taking into consideration not only the foreign language needs—EFL reading, writing, listening and speaking skills, as well as technical vocabulary expansion—but also the overall educational needs of second-year university Engineering EFL students, a collaborative instructional model with the principal goals of creating a practical language learning environment that would be conducive to effective learning and nurturing the development of essential academic, professional and social skills was designed. Specifically, the goals were for students to:

- 1) Use English in an authentic activity,
- 2) Develop their cognitive and creative thinking skills,
- 3) Improve their social skills through collaboration,
- 4) Develop their research skills,
- 5) Improve their computer skills, and
- 6) Gain experience of giving a (PPT) presentation.

## Procedure

1) Select a research topic: 52 students were randomly divided into groups of 4–5. Each group selected a research topic related to science, technology and society. Due to time constraints the instructor provided a selection of research topics from which the groups could choose. Examples are:

- Economic Growth and Human Development
- Energy—Fuels for the Future
- NASA Landsat Satellites
- Technology for Human Development

(Approach: *Cooperative*.)

2) Learn basic facts: All group members were responsible for acquiring fundamental knowledge about the research topic. For example the ‘NASA Landsat Satellites’ group members had to answer questions such as:

- What is NASA?
- What is Landsat?
- What is the main job of Landsat satellites?
- Describe two ways in which the data from Landsat would be useful to Japan.

(Approach: *Cooperative*)

3) General Group Outline: Students discussed the project and each person decided on a specific aspect of the topic (all related to society) that they would research.

They then outlined the way they would organise the group presentation. (Approach: *Collaborative*)

4) Individual Outline: This second outline showed in greater detail, how the individuals in a group planned to organise his/her research data.

5) Detailed Group Outline: This outline contained the main points of each group member’s talk. (Approach: *Collaborative*)

6) 10-Minute Group Presentation: While one group was presenting, the rest of the students were taking notes, using the detailed outlines the groups had prepared. This made it easier for students to follow the presentations.

7) Review: After the presentations, students had 25 minutes to speak with each other in order to confirm information, gather missing data and study their notes. (Approach: *Collaborative*)

8) Assessment: In the first class, students were given assessment guidelines for the oral presentation. The instructor did the assessment while the students were speaking. Students were not required to assess themselves. However, they were asked to make a personal assessment of their own performance and those of other groups. Shortly after the presentations, students were given 20 minutes to review their notes and exchange information with their classmates. During this time (in the same classroom) the instructor typed 20 test questions based on the contents of the presentations onto a PPT slide, and then had the students do a written test (answer the test questions on the PPT slide) without referring to their notes. (Approach: *Cooperative*)

## Results

At the end of the course, by means of a short questionnaire, students were asked about what they had learned and liked about the experience. The students’ responses were overwhelmingly positive:

- “I used the software for the first time.”
- “It was the first time for me to make a presentation.”
- “I learned new information.”
- “Talking to everybody.”
- “I learned a method for researching a topic.”
- “I could use the computer.”
- “Useful to understand my friend’s research.”

- “I learned to use the Internet.”
- “I gained knowledge about the topic I researched.”

The few students who answered negatively said:

- “It’s my weak point.”
- “I didn’t know how to use the computer.”
- “I can’t use PPT.”
- “A presentation in English is difficult.”
- “I can’t understand.”

In addition to researching English resources on the Internet, learning relevant information and giving an oral presentation in English, students also acquired elementary skills in collaboration, data organisation, computer usage and note taking.

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