Combining the Techniques of Joint Application Design and Cooperative Learning in the Information Systems Classroom

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Abstract

It is imperative for Information Systems professionals to be able to work well with other people. Information Systems development is a social process that requires this. It is difficult for tertiary institutions to teach these skills to students while also teaching them the technical skills that they need. This paper proposes a method whereby the techniques of Joint Application Design (JAD) used in industry can be combined with the techniques of cooperative learning in the classroom. It is proposed that this method, will not only promote the learning of the modeling techniques that are used, but will also promote the learning of some of the interpersonal and group skills that are needed by Information System's graduates. A discussion of some of the data from a case study done is presented to support these claims.

Keywords: Information Systems Education, JAD, cooperative learning.

I. INTRODUCTION

Tertiary institutions have tended to prepare their students very well technically, but have often neglected to give students the skills that they will need in order to work with users, find shared meanings and practice creative, unstructured thinking [Goyal, 1995/1996]. In a recent survey, van Slyke, Kittner and Cheney [1998] found that general thinking, communication and interpersonal skills were considered to be the most important characteristics needed by Information Systems (IS) graduates. They say, *"Employers want IS graduates who can think, communicate, and work well with others. They also want individuals who have a good grounding in basic IS skills such as systems analysis and design and database concepts. These employers seem to be less interested in more specific technology skills."* [Van Slyke, Kittner & Cheney, 1998, p.l 0]

The use of group work at tertiary institutions can give students some of the essential skills of teamwork needed

for their career. Communication skills like listening skills, the ability to manage conflict, the ability to deal with criticism assertively rather than aggressively, being able to persuade and influence others, as well as how to negotiate are considered important in today's world and can be practiced in the group environment [Rooff- Steffen, 1991].

This need for more than only technical skills is also recognized by the developers of the Information Systems '97 Curriculum [Davis, Gorgone, Couger, Feinstein & Longenecker, 1997], who list both communication and interpersonal relationships as being among the main characteristics needed by the IS graduate. The suggestion is made that IS departments should try to use methods of learning that foster the building of these skills, while the students learn the more technical skills needed. The method of using JAD and co-operative learning techniques, proposed in this paper is one attempt at achieving this.

2. **CO-OPERATIVE LEARNING**

Co-operative learning is the instructional use of small groups where students work together to maximize their own and each other's learning [Johnson, Johnson & Smith, 1991]. They draw on each other's strengths and assist one another in completing the task. Co-operative learning encourages supportive relationships, good interpersonal skills and higher- level thinking abilities.

Co-operative learning is not just another name for group work. Simply placing students in groups and telling them to work together will not mean that they know how to co-operate or that they will co-operate.

Johnson, Johnson and Smith [1991] suggest that there are five basic elements that should be included in a co- operative lesson. These are positive interdependence, face-to-face primitive interaction, individual accountability, social skills and group processing. These five elements will be described briefly below:

Positive interdependence Positive interdependence is achieved when each member of the group perceives that he or she cannot succeed unless the other members also succeed and that collaboration is necessary in order to complete the task. The work of the various team members should be beneficial to the other team members. Sharing resources, providing mutual support and encouragement and celebrating joint successes is important to the group [F elder & Brent, 1994] .

Face-to-face primitive interaction Some or all of the work should be done interactively with group members giving feedback, challenging one another's reasoning and teaching and encouraging one another [Felder & Brent, 1994]. Individuals should encourage and facilitate each other's efforts to achieve, complete tasks and reach the goals of the group [Johnson, Johnson & Smith, 1991].

Individual accountability There are two aspects to individual accountability. One is that the performance of the student needs to be individually assessed and the second that each member of the group should be held responsible by the other members for contributing his or her fair share of the work [Johnson, Johnson & Smith, 1991].

Social skills Social skills are the fourth essential element for co- operative learning groups according to Johnson, Johnson & Smith [1991]. This aspect involves using the appropriate interpersonal or social skills at the proper time. Students should get to know and trust

each other, communicate accurately and unambiguously, support one another and resolve conflicts constructively. Students should be encouraged to develop and practice trust-building, decision-making, communication and conflict management skills [Felder & Brent, 1994]. The skills of co-operation are essential for the workplace today [Hamm & Adams, 1992].

These skills are not ones that we can expect students to have instinctively, which means that we may have to teach the skills to our students if they are to be effective.

Group processing Group processing is defined by Johnson, Johnson and Smith [1991, *p.ll*] as *"reflecting on a group session to describe what actions of the members were he/pfu/ and unhe/pfu/ and to decide what actions to continue or change"*. This will help to clarify and improve the effectiveness of the collaboration. Felder and Brent [1994] support this by saying that team members should set up group goals, assess how they are achieving as a team and identify changes that they need to make, to become more effective.

3. COMBINING TECHNIQUES OF CO-OPERATIVE LEARNING WITH JAD

Co-operative learning literature has many ideas for promoting the five characteristics described above. Some of these techniques were combined with the techniques of JAD used in industry in order to promote learning as well as effective group processing.

Preparing the students for the JAD sessions A series of classes were set up to allow the students to learn some of the interpersonal skills and small-group skills needed for co-operation. Some of the skills taught included communication skills, listening skills, group dynamics and group decision-making skills. The JAD skills of facilitation, scribing and group participation were also taught to the students. The importance of these skills in industry was emphasized. The students were given the opportunity of practicing these skills.

Group composition The ideal group size is seen by some as six, with smaller group sizes suggested for those who are not used to working co-operatively [Jaques, 1991]. Using the white boards and having some structure to the group (as described in the section on the classroom layout) does allow students to be able to communicate more easily but the group size should not exceed eight if possible. This will allow all team members to

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contribute while still offering different perspectives, which can be debated.

There is some debate in the co-operative learning literature about the use of heterogeneous or homogeneous groups with respect to academic ability, race and sex. As it was felt that getting the opportunity to work with people different from themselves was important so it was decided that a heterogeneous approach would be best. However, Miller and Harrington [1990] warn against making people aware of the differences by placing too much emphasis on having the right group composition with respect to race or sex.

It was decided to create heterogeneous groups with respect to the students' knowledge of different business areas that would be modeled, academic ability and language. The students were asked to **fill** in a questionnaire in which they were asked if they had worked in, often used, seldom used or never used a particular business area. The business areas were chosen to get a wide spectrum of students within the groups, for example, a free clinic, a health club, a restaurant and so on. Students from different language groups were placed together to try to have more heterogeneous groups so that the students would be "forced" to use English which was the only language understood by all.

Instructional materials Methods of co-operative learning, like the Jig-saw method, propose giving the different students in the group different material in order to promote positive interdependence and individual accountability [Abrami, Chambers, Poulsen, de Simone, d' Appollania & Howden, 1995].

An example helps to illustrate how this aspect was dealt with. The students were asked to draw a Use- Case Model and an ER diagram for the library, for example. Instead of giving all the students the same material, only an overview was given to all the students. The rest of the material was divided among certain of the group members who were termed the «users" for the session. One of the members was given the material with details of what happens at the front desk, another for the ordering of books and a third for the financial aspects of the library. As the students were put into groups based on their knowledge of the different business areas, the students with the most knowledge of a particular business area would be made a «user" in that particular area. This put each of the students into the situation where they had to participate, as they were the only people with the information needed by the group. It was also more comparable to what happens in industry where the

JAD sessions are meant to bring together users with different knowledge.

Layout of the classroom The classroom was one that had five white boards around the classroom and each group was assigned to a board. The desks and chairs in the classroom could be moved and the students sat in the classic horseshoe shape with the facilitator at the board at the front as is suggested for a JAD session used in industry [Carmel, Whitaker & George, 1993]. This shape allows all the students to see each other and the board thus promoting effective communication.

Running the JAD sessions The students would take turns at being facilitator or scribe. The student facilitator would stand at the board, recording the design on the board and coordinating and controlling the session and the scribe would record the solution on paper. The facilitator was expected to make sure that all students participated, that none dominated and that the group stayed working towards the goal. If there was conflict, the JAD (acilitator was also expected to help the group gain consensus and negotiate a solution.

Monitoring and intervening by the lecturer The task of the lecturer was not to solve problems or negotiate when there was conflict but rather to make sure that the JAD facilitator was doing his or her job. The lecturer also checked the solution at the end and discussed any problems with the group as a whole.

Co-operative learning suggests that the lecturer needs to monitor the groups, both with respect to their understanding of the material, as well as their group dynamics. The lecturer tried to point out to groups where their group processing was causing problems. The students were still expected to get the solution as a group, however, and the lecturer did not act as referee in conflict situations.

Evaluation of group process Co-operative learning literature suggests that students should be given time at the end of a session to consider their own group processing and what they need to keep and what they need to change [Hamm & Adams, 1992]. It was decided to do this by using questionnaires where the students were asked to evaluate their group, the interaction within the group and the group cohesion. The lecturer then looked through these and made a summary for each group of any problem areas that were encountered. The groups discussed these problem areas at the beginning of the next class.

Assessment The lecturer would discuss the students' Use Case or ER diagram with the group when the group thought that they were satisfied with the result. No marks were given to the group, but this did not seem to stop the groups from trying to get the best solution. Individual accountability was also promoted in that the students knew that they would be tested individually on the modeling techniques in any subsequent tests or examinations.

The students evaluated one another with respect to their participation in the group and their abilities to act as facilitator during the last of the three JAD classes.

4. RESEARCH METHOD

The research paradigm being used for the study can be considered to be interpretative. In other words, we were trying to get a deep understanding of the situation from the perspectives of the different actors involved, rather than getting an objective, generalisable result. The lecturer was also the researcher, which makes an objective approach impossible. No attempt was made to have experimental control groups or to say that anything learnt from this research will be generally applicable in other places. The researcher will try to give enough information to contextualize the research so that the readers can decide for themselves if the method would be appropriate for their situation as suggested by Klein and Myers [1998].

The Case Study method was used as it enables one to get this deep understanding by investigating how the method is used in its natural environment. Various methods of data collection were used, namely open and closed questionnaires to the students, observations by an independent observer and pre and post-testing of individual's knowledge of the modeling techniques and the group processing. Space limitations make it impossible to give a detailed discussion here of all of

the results of the questionnaires and observations, but some of the more interesting ones have been chosen to highlight.

5. CASE STUDY RESULTS

There were 113 students in the class with 87 of them completing the main questionnaire. The students were split into 3 classes for the group skills preparation activities as well as the JAD sessions themselves. There was a maximum of 42 students in a class. The demographics of the students used in the study are depicted in Table I.

The students were mostly from the three language groups found **in** the Eastern Cape **in** South Africa, namely, English, Afrikaans and Xhosa. There are two streams of students who do the Information Systems II subject, namely a Business stream and a Technical stream.

Table 2 highlights the students' experiences of group work using the JAD and co-operative learning techniques.

Factors like interacting with other group members, hearing other people's ideas and working as a team, were among the most common factors that the students enjoyed about the group work according to the open-ended questions asked. The most common things that they disliked were people who did not participate and people who did not take their ideas into consideration. Most of the students felt that their ideas were listened to and taken notice of. There seemed to be a problem that some of the students are perceived by their fellow students as being of a lower status than themselves. It is a sad reflection on South African society to note that 8 of the 10 people, who felt that their ideas were not taken into consideration by others, were Xhosa speakers. One of the female students also complained about being treated like the secretary by the "superior" males in her group. The

Gender		Language		Stream	
Male	60(69%)	English	50(57.5%)	Business	58(66.7%)
Female	27(31%)	Xhosa	12(13.8%)	Technical	29(33.3%)
		Afrikaans	23(26.4%)		
		Other	2(2.3%)		
Total	87(100%)	Total	87(100%)	Total	87(100%)

Table 1: **Composition of students in the study**

Questions:	Always	Mostly	Seldom	Never
Did you enjoy working in groups?	25.2%	64.4%	9.3%	1.1%
When you were a member of the group and not the facilitator, did you feel that the facilitators gave you a chance to have your say?	40.7%	51.2%	8.1%	0.0%
Did you feel that you were able to contribute to the group?	44.7%	48.2%	7.1%	0.0%
Did you feel that all group members made contributions to the group?	17.4%	66.3%	16.3%	0.0%
Did you feel accepted as a group member?	71%	22.1%	5.8%	1.1%

Table 2: Students' experiences of group work using JAD techniques

observer also noticed that some of the groups were dysfunctional with respect to their acceptance of people from minorities within the group. She noted one group where three dominant females totally ignored the input from the males in the group. This problem of stereotyping and bias should be addressed with the students.

The students were also asked to comment on whether or not they perceived that the JAD workshops had helped them to learn about the modeling techniques and group skills. A person's perception of their ability to work in a group is a measure of their confidence to do so and is therefore important.

Many of the students commented in the open-ended part of the questions that they felt more confident

about sharing their ideas and about interacting with others within a group. It was interesting to note that quite a number mentioned that they felt that they had learnt to listen to other people and give them a fair chance.

The students were given a test question on Use Cases before the JAD sessions began. They were subsequently given a question in the examination on Use Cases that was deemed by the three lecturers in Information Systems II to be of the same standard as the first one. Unfortunately the same could not be done for ER diagrams as the students were still busy with ER diagrams at the time of the first test and the question in the examination was, therefore, more difficult than the one in the first test.

	Already Knew	Learnt a lot	Learnt a Little	No help at all
Do you feel that the JAD techniques used in the classroom were effective in helping you to learn?	3.5%	60.5%	32.5%	3.5%
Do you feel that the JAD techniques helped you to feel more confident about how to act within a group?	18.6%	48.8%	26.8%	5.8%
Do you feel that the JAD technique has helped you to learn how to interact with other people?	26.7%	36.0%	31.5%	5.8%
Do you feel that the JAD technique has helped you to learn how to speak in front of small groups of people?	22.1%	46.5%	20.7%	4.7%

Table 3: Students' perception of their learning

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The JAD sessions were held over 3 classes of I ~ours each. The students did both Use Cases and ER diagrams with approximately 20 minutes being spent on Use Cases during each session, giving approximately 60 minutes of extra time. Again no experimental evidence is available to say spending the time using the JAD techniques would have been any more effective than spending that time doing individual study. No attempt was made to ensure that the students did not learn from any other means as it was felt that this would be unethical as well as unnatural. These limitations should be kept in mind by

the reader when considering that the students' average percentage for the question went up from 70% to 79%.

The students were asked their preference with regard to the methods used for learning the modeling techniques. Seventy-six percent chose the JAD method, 8% chose conventional group work and 16% felt that they would rather work individually. The students thus seemed to feel that the JAD techniques helped them more than conventional group techniques or working individually.

Communication

Interpersonal relationships

accurately observe, note and explain observations of events actively listen and express complex ideas in simple terminology organize and make presentations write memos, reports and documentation

effectively work with people of diverse backgrounds
effectively work with people at all corporate levels
lead and facilitate teams in a collaborative environment develop win-win approaches empathetically listen and seek synergjstic solutions

listening, observing and documenting
interviewing and speaking negotiation and facilitation presentation and interpretation ofdata
multimedia development and utilization
computer and video conferencin~echniques

leadership, management and organization
small group communications and motivation
organization, team and individual goal setting
shared vision and responsibility cultural diversity

Table 4: Capabilities and knowledge expected for an IS program [Davis, Gorgone, Feinstein & Longenecker, 1997, p.12]

6. **CONCLUSION**

The method of combining co-operative learning techniques with those of JAD seems to have been effective both in the learning of the group skills and in learning of the modeling techniques.

The Information Systems '97 Curriculum suggests that IS graduates should have the skills of communication and interpersonal relationships as shown in Table 4. They say that these skills, among others, should be fostered by the teaching and learning methods used within the IS classroom.

Each of the students is given the chance to be the facilitator and the scribe each week. As facilitator, they have to learn to negotiate and facilitate. They also learn to listen to everyone else and lead a

discussion. They have to lead and help the rest of the team to come to a consensus about a specific topic.

As the scribe, they also have to develop their listening skills and their documentation skills.

As team members and when playing the other roles, they learn to listen, to explain their ideas to others, to work with diverse students and to communicate in a small group situation. These skills cover most of those included under the headings of communication and interpersonal relationships in the IS '97 Curriculum, as shown in Table 4.

In addition to these skills the students are also learning the modeling techniques. This method helps students to discover misconceptions that they might have. As they hear the ideas of others and have to defend their ideas to others, they realize any

difficulties that they are experiencing. The students mentioned this as being one of the best things about using the JAD methods. As the group uses the white board for their solution, they are almost forced to work together as a group, rather than have one student do everything for the group.

There are still problems that are experienced, however. The diversity of students seems to be causing some students to dominate and others to withdraw their participation. This is being studied in further research.

While using a case study might limit the generalizability of this research, it is hoped that IS lecturers can adapt the method to their context. The research has been done in post-apartheid South Africa, and it would be interesting to see if the methods used were effective in other cultural contexts.

The JAD techniques are appropriate for the learning of any of the modeling techniques that students find difficult in the study of Information Systems. As the students argue, debate and hear the opinions of others, they learn the modeling techniques together with the some of the social skills that they need to be effective systems analysts.

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