Obstacle of Team Teaching and Collaborative Learning in Information Security

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ABSTRACT

The field of information security includes diverse contents such as network security and computer forensics which are highly technical-oriented topics. In addition, information forensic requires the background of criminology. The information security also includes non-technical content such as information ethics and security laws. Because the diverse nature of information security, Shing et al. has proposed the use of team teaching and collaborative learning for the information security classes. Although team teaching seems to be efficient in information security, practically it needs a few challenges. The Purdue's case mentioned in Shing's paper has funding support of National Security Agency (NSA). However, a vast amount of resources may not be available for an instructor in a normal university. In addition, many obstacles are related to the administration problems. For example, how are the teaching evaluations computed if there are multiple instructors for a single course? How will instructors in a computer forensics class prepare students (criminal justice majors and information technology majors) before taking the same class with diverse background? The paper surveyed approximately 25 students in a university in Virginia concerning the satisfaction of team-teaching. Finally, this paper describes ways to meet those challenges.

Keywords: Information Security, Collaborative Learning, Obstacles of Team Teaching, Team Teaching, Information Systems Education, and Teaching Computer Forensics.

1. INTRODUCTION

Information security is defined as "the concepts, techniques, technical measures, and administrative measures used to protect information assets from deliberate or inadvertent unauthorized acquisition, damage, disclosure, manipulation, modification, loss, or use" [6]. On the document of National Institute of Standard and Technology, ''Federal Information Security Management Act of 2002", [7] the term 'information security' means "protecting information and information systems from unauthorized access, use, disclosure, disruption, modification, or destruction in order to provide:

(A) integrity - guarding against improper information modification or destruction, and includes ensuring information non-repudiation and authenticity.

(B) confidentiality - preserving authorized restrictions on access and disclosure, including means for protecting personal privacy and proprietary information.

(C) availability - ensuring timely and reliable access to and use of information."

In other words, information security is a process to guard against the intruders to protect the integrity and confidentiality of information inside the computer systems and provide the availability of information. It protects not only the hardware, software and data in the computer system, but also the management and the personnel involved. In order for the system to effectively reach its goal, educating the computer users to have an appropriate ethics is also important. Today, information security is a necessity. Information security fields involve computer security, network security, database security,

cryptography, security management, computer forensics, and computer ethics. Computer security discusses the protection of the integrity of computer hardware and software. Network security emphasizes on the security on computer network infrastructures and protocols to provide the information availability. Database security protects mainly on the integrity of data, storage and its management software. Cryptography provides the privacy of the data and software to guarantee their confidentiality. Computer forensics identifies the computer laws and provides various tools to examine the evidence of computer crime and prosecute the suspects in the court. Security management efficiently controls the security process in practice, including personnel and tools. Computer ethics fundamentally educates computer users to avoid committing computer crimes and help securing computer systems. There are highly abstract mathematical formula implemented in cryptography and there are philosophical views involved in computer ethics. The computer forensics needs to not only address the technical knowledge on computer systems and network environment, but also discuss the criminal justice systems and laws about computer crime. Because the field involves diverse knowledge and skills, it is quite challenging to teach effectively in the field.

2. LITERATURE REVIEW

There is a significant amount of discussion in the collaborative learning and team teaching [1, 2, 3, 4, 9]. Due to the dynamic changing elements and complexity of the knowledge involved in the information security fields, Shing et al. [10, 11] have proposed the use of team teaching and collaborative learning to effectively teach the information security classes. They have discussed the theory collaborative learning and the advantages of team-teaching for information security. They stated that the collaborative learning is a teaching technique based on the mixture principles of constructivism [8, 5] and socialism [12]. Constructivists believe knowledge must be constructed from experience by learners whereas socialists believe knowledge must be constructed from learner's social experience by interacting with their environments. Five characteristics are identified for the collaborative learning [11]:

1. Knowledge is constructed by both learners and an instructor.
2. Learners are active knowledge constructors.
3. Learners develop their knowledge and skills based on their own talents.
4. Contexts occur in classroom and created among instructors.
5. Personal transaction among learners and between learners and the instructor are essential.

The advantages of collaborative learning are: 1) It "will stimulate the learner's potential based on better understanding material through group discussions and better test preparations" and 2) the instructor "can control the learning process when the atmosphere isn't appropriate for active learning" [11]. The advantages of team teaching are that each instructor can contribute his/her expertise in the classroom and learner can construct their knowledge from different point of view. Shing et al. [10, 11] discussed a case study in a faculty development workshop at Purdue University, which was supported by NSA, to show the effectiveness of team teaching and collaborative learning.

3. RESEARCH ISSUES: OBSTACLES OF TEAM TEACHING AND COLLABORATIVE LEARNING

In practice, it is quite challenging to control the learning environment to meet the requirement of collaborative learning when learner's background is quite heterogeneous. For example, in order to teach an undergraduate computer forensics class in which there are criminal justices majors and information technology majors, how does an instructor teach criminal justice students to construct knowledge on technology without letting information technology students boring? On the other hand, how does an instructor stimulate technology students to be an active knowledge constructor in criminal justice field successfully? How does an instructor provide an environment to establish personal transaction between students of technology majors and criminal justice majors and also between technology instructor and criminal justice students or between criminal justice instructor and technology students?

There are some difficulties involved in team teaching also. From the classroom point of view, which instructor is in control of the classroom? From the administration point of view, how do administrators assign the classroom and teaching load to each instructor and how to evaluate each instructor?

4. A PILOT STUDY OF TEAM TEACHING AND COLLABORATIVE LEARNING

The first course, which was proposed to use team teaching and collaborative learning in information technology (or ITEC) department (which belongs to College of Arts and Sciences) and in criminal justice (or CRJU) department (which belongs to College of Information and Sciences) at Radford University, is an undergraduate senior level special topics course: Introduction to Computer Forensics. It was taught by an ITEC and a CRJU instructors equally and each instructor met students once a week in the fall semester of 2005. The ITEC professor attended in the CRJU lectures; however, not vice versa. The class was offered as a three-hour credit hour elective with the general education course 'Introduction to Information Technology' as its prerequisite. There were twenty-four students in the class. Eleven of them were ITEC majors (two were female), thirteen were CRJU majors (five were female). 83% of them were seniors and the rest were juniors. Each instructor is responsible for 50% of each student's grade. At the end of the semester each instructor was evaluated by all twenty-five students. The class was counted as one-hour teaching assignment for the ITEC instructor but it was counted as a two-hour teaching assignment for the CRJU instructor. There were two assignments, two quizzes and one group project required by the CRJU instructor. In addition, there were six assignments, one team project and a final exam required by the ITEC instructor. All the homework in technology were team work. There were three students in each group. Each group leader was a student from ITEC. In addition to providing the notes from Purdue University on-line, lecture notes also included background material developed specifically for non-ITEC majors. The topics for the background material were computer hardware, software, file systems, operating systems and computer networks. Most ITEC assignments were modified from the assignments from Purdue's classes. The team projects were forensics on file systems such as FAT, NTFS, EXT3, HPFS, HFS, UFS, REISER and GFARM. Due to limited resources, the class did not get any administration support. Only one Windows 98 workstation was set up for students to use. Software used for the class were

DriveSpy, HexWorkshop, FTK and EnCase. They were all free trial versions. Students were required to set up their machines for their projects. A survey questionnaire (See Appendix) was given to all students at the end of the class as the formative evaluation for team teaching and collaborative learning. A closed-book final exam was given to assess students' basic computer forensics knowledge (or summative evaluation) on both criminal justice systems and information technology.

5. PILOT STUDY RESULTS

Formative Evaluation

Figures 1 to 3 shows the profiles of students in the class. The data further showed that 70% of students of CRJU majors considered that the class was hard, while only 10% of ITEC majors thought it was difficult. There were 30% of the non-majors who liked the background material. This suggested that more background materials are needed for development. The study showed that most students liked team work in technology and preferred working with three or four students per group. Only 13% of students didn't like group work due to either group leader did not understand enough to lead or due to the leader did most of the work. Most teams were satisfied with their team leaders in terms of understanding the material and working on their projects. As shown in Figure 4, the survey results show that almost 60% of the students do not like team teaching as conducted. All of them commented as "two separate course load", "too confusing with 2 professors" and "need 2 professors in every class". They recommended that both instructors appear together and avoid excessive work load. However, students who support team teaching commented such as it "gives two different perspectives" and "gives two different points of views". Figures 5 to 15 show the results of other questions answered by students.

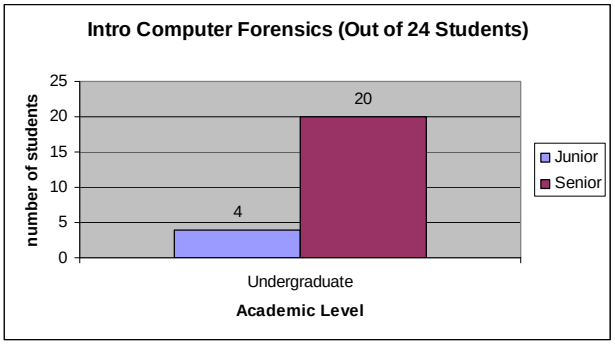


Figure 1. Academic Level (Question 1)

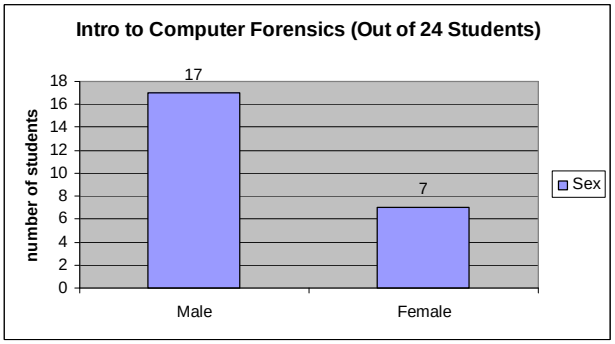
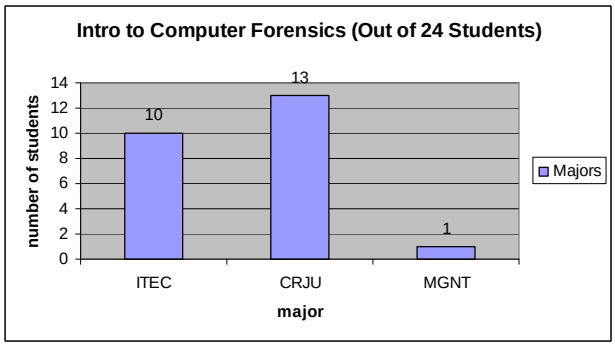


Figure 2. Gender (Question 2)



[Note: MGNT represents Management Information Systems]

Figure 3. Major (Question 3)

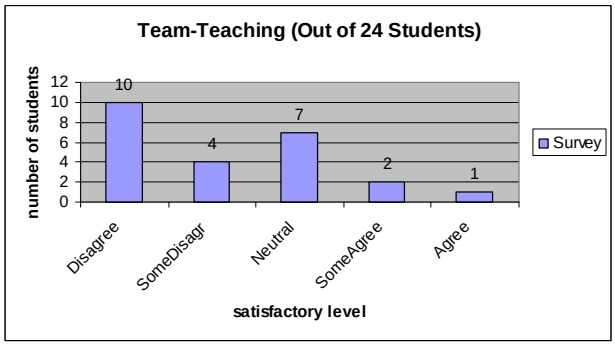


Figure 4. Do you like the Team-teaching? (Question 4)

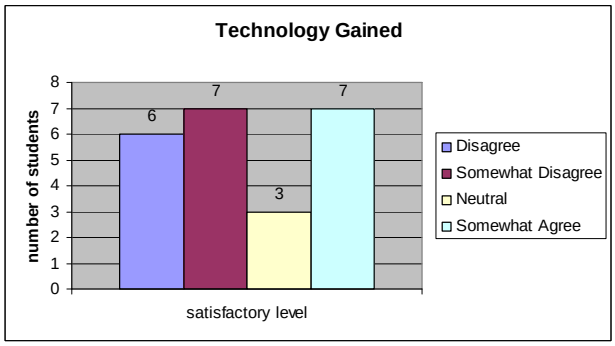


Figure 5. Have You Learned More about Technology in the Class? (Question 5)

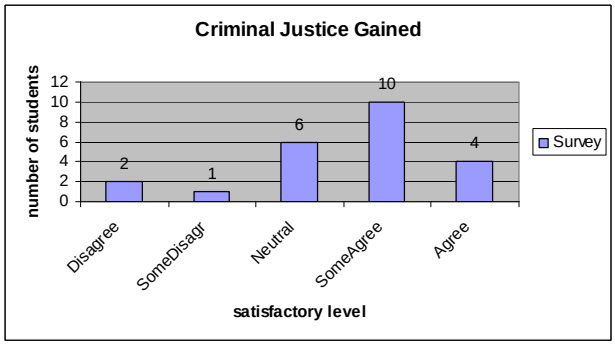


Figure 6. Have You Learned More about Criminal Justice Systems in the Class? (Question 6)

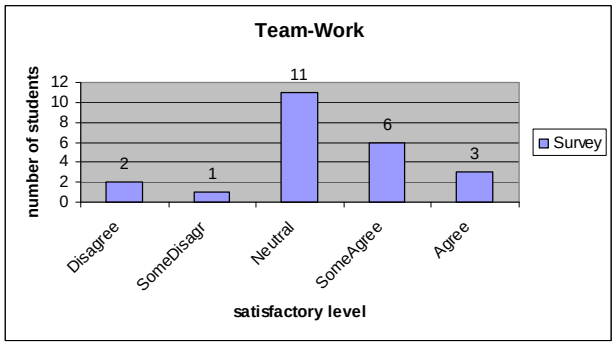


Figure 7. Does the Team Work Help You Learn in the Class? (Question 7)

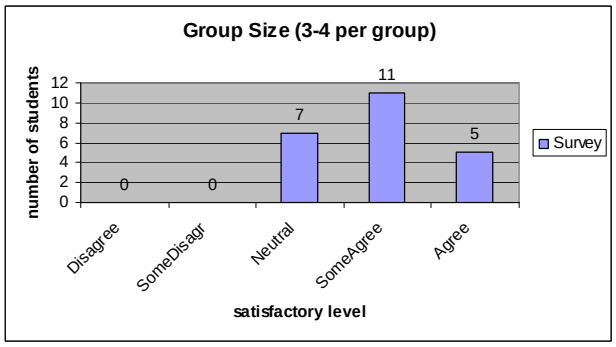


Figure 8. Is the Group Size (3/4) Appropriate? (Question 8)

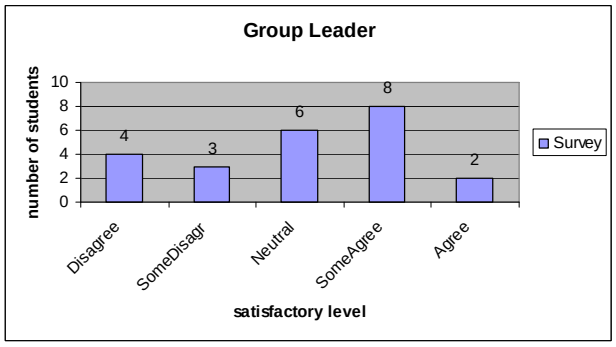


Figure 9. Does Your Group Leader Lead You to Understand More in the Class? (Question 9)

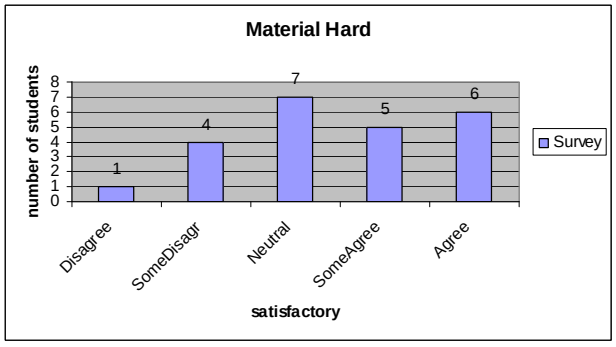


Figure 10. Is the Class Material Too Hard to Understand? (Question 10)

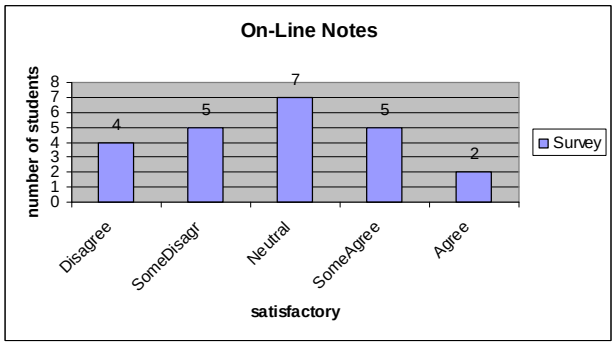


Figure 11. Do the On-Line Lecture Notes Help You Understand More in The Class? (Question 11)

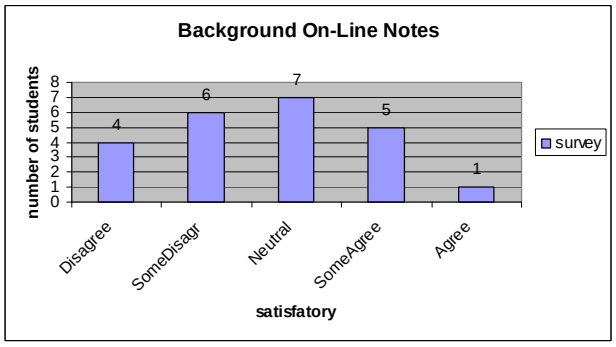


Figure 12. Do the On-Line Lecture Notes on Technology Background Help You Understand More in the Class? (Question 12)

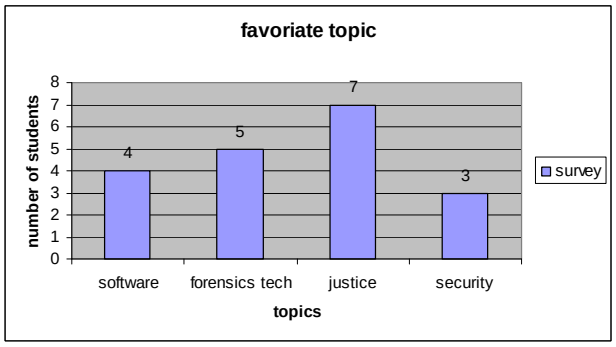


Figure 13. What is the Best Part of the Course? (Question 14)

Figure 14. Do You Understand More about the Content of the Course after The Class? (Question 15)

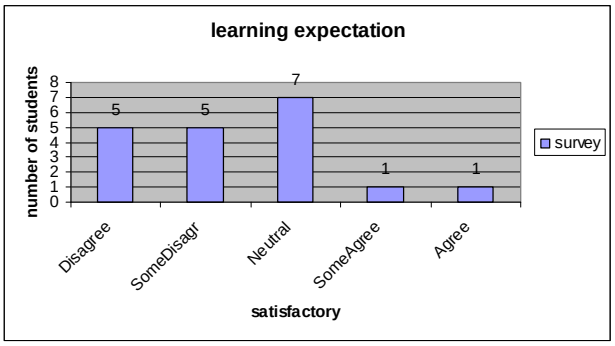


Figure 15. Have You Learned What You Want to Learn From the Class? (Question 17)

Summative Evaluation

All the questions in the final exam were from the instructor's manual developed by the consortium group according to Bloom's Taxonomy of learning. The final exam covered basic questions on both criminal justice systems and forensics technology. The topics included e-mail tracking, media storage, justice systems procedures and windows operating environment. The learning levels ranged in areas of knowledge, comprehension, application and analysis. The data showed that there was no statistical difference (with 95% confidence) on learning levels between students from ITEC and CRJU majors and between male and female students. The performance on justice systems/justice procedures topics is better than that on forensics technology topics.

6. CONCLUSION

This paper discusses possible obstacles of team teaching and collaborative learning in information security courses. An experiment was conducted in a computer forensics course at Radford University, Radford, Virginia. The plot study shows about 60% of students were not in favor of team-teaching. Due to the small sample size used in the pilot study, the variance was large and the result might not be very accurate. However, the data analysis may help us understand the reality of team-teaching and collaborative learning in the information security and computer forensics courses. The team-teaching by ITEC and CRJU instructors must coordinate very well. The background material for the class is needed to be developed for both ITEC and CRJU majors.

7. APPENDIX: QUESTIONNAIRE

I am conducting research relative to team teaching in information security area. I would appreciate your assistance by filling in the answers to my questionnaire. All information will be held in strict confidence and will not affect you grade.

1. What is your academic level?

A. Freshman
B. Sophomore
C. Junior
D. Senior
E. Graduate student
F. Other _____

2. What is your gender?

A. Male
B. Female

3. Please identify your major (not concentration)?

A. ITEC (Information Technology)
B. Criminal Justice
C. Computer Science
D. Management Information Systems
E. Information Technology in College of Technology
F. Other_____

Please write down all your concentrations if you have.

4. Do you like the team-teaching (More than one professor teach a class) set-up in the class?

1	**2**	**3**	**4**	**5**
Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree

Please comment on why/why not you like the set up.

5. Have you learned more about technology in the class?

1	**2**	**3**	**4**	**5**
Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree

6. Have you learned more about criminal justice systems in the class?

1	**2**	**3**	**4**	**5**
Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree

7. Does the team work help you learn in the class?

1	**2**	**3**	**4**	**5**
Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree

Please write down what and why the team work help/not help you learn in the class?

8. Is the group size (3/4) appropriate?

1	**2**	**3**	**4**	**5**
Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree

9. Does your group leader lead you to understand more in the class?

1	**2**	**3**	**4**	**5**
Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree

Please comment on how to choose leader and what's the best group size.

10. Is the class material too hard to understand?

1	2	3	4	5
Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree

11. Do the on-line lecture notes help you understand more in the class?

1	2	3	4	5
Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree

12. Do the on-line lecture notes on technology background help you understand more in the class?

1	2	3	4	5
Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree

13. What is the best part of the notes help you understand more in the class?
Please specify all topics:

14. What is the best part of the course? (Circle more than one if needed)

A. Use software tool
B. Understand technology knowledge behind Computer Forensics
C. Understand Criminal Justice systems
D. Understand information security
F. Others: _____

15. Do you understand more about the content of the course after the class?

1	2	3	4	5
Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree

16. What did you expect to learn from the class before you take it?
Please specify:

17. Have you learned what you want to learn from the class?

1	2	3	4	5
Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree

18. Please write down any suggestion about how to improve on course material for teaching this course in the future.

19. Please write down any suggestion about how to improve on equipment setup for teaching this course in the future.

20. Please write down any suggestion about how to improve on delivering the course material for teaching this course in the future.

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