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Measuring Transactional Distance in Web-based Learning Environments

Drew E. Ditto

Worcester Polytechnic Institute

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Measuring Transactional Distance in Web-based Learning Environments

An Interactive Qualifying Project Report submitted to the Faculty

WORCESTER POLYTECHNIC INSTITUTE

In partial fulfillment of the requirements for the Degree of Bachelor of Science

Project Advisors:

Karen Lemone

Murali Mani

Submitted by:

Drew Ditto

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Abstract

Transactional Distance is a component of distance education that has yet to be given a concrete definition or method of measurement. This project developed a method of measuring Transactional Distance in web-based distance learning classes which derives from a survey given periodically to students. This project examined an initial survey provided for the purpose of measuring Transaction Distance and used that as a starting point to develop a survey that more accurately retrieves relevant data.

Executive Summary

Transactional Distance is a component of distance education theory, and a measurement of psychological distance between individuals and components in a distance learning class. The larger Transactional Distance is, the greater the room for misunderstanding between participants and administrators. There are varying theories detailing the components of Transactional Distance, but there have been no established methods to measure it. There is also a lack of prominent studies about Transactional Distance in web-based learning environments.

Since Transactional Distance was first defined by Michael G. Moore in 1972 there have been multiple revisions of the theory. As time has progressed and methods of teaching Distance Education have changed, varying theories of Transactional Distance have been put forward. The latest theory, and first major study to be designed around web-based learning, was put forward by Zhang. Zhang's theory breaks Transactional Distance down into four groups of interactions: Student-Student, Student-Teacher, Student-Content, and Student-Interface.

This project was designed to develop a method of measuring Transactional Distance in web-based learning environments. This was done by administering a previously designed survey to gather information pertinent to Transactional Distance from an online class. A measurement was then calculated from the survey results. The survey administered to the sample class was designed and all data gathered before this project settled on using Zhang's theory. As such, the survey did not fully satisfy some of the informational needs of an accurate calculation and needed to be redesigned.

A measurement of Transactional Distance for the sample class was calculated

using data from the initial survey. This project analyzed which questions on the initial survey had any relevance to Zhang's theory of Transactional Distance, and whether these questions could be rephrased to be more accurate. By using these rephrased questions and designing more questions, this project created a new survey tailored to more effectively measure the four interactions that comprise Zhang's definition.

This new survey more effectively reflects information contained in Zhang's definition of Transactional Distance. However, this new survey has not been tested or given to a web-based class. As such it would be a good idea to test the survey proposed in this project. This could be done easily by repeating the methods used by this project on the new survey.

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Chapter 1: Introduction

Education is a field that continually develops in both theoretical and practical paradigms. Operating from the core fundamental value that an educated world is a better world, the great minds in the field of education are always attempting to provide more and better ways to learn. A prime example of expanding education using current technology is web-based distance education.

First starting with land based mail and a system called correspondence courses, college professors would mail class information and work to individual students. Students would then complete the work and mail it back to be graded. With the advent of the internet and furthering of development in browser based platforms, it seems almost natural that distance education would take advantage of such a form of communication. Near instant transmission of data across the internet is a large improvement over physical mail.

In accordance the classroom extended into the virtual arena of the internet. Like any revolutionary idea, the advent of web-based distance learning sparked a long series of studies to determine its effectiveness. Of special concern was how effective an online class is compared to a more traditional classroom approach. Before web-based distance learning could be compared to the traditional classroom approach a method of comparison needed to be developed. In order to compare two elements there needs to be observable traits. Transactional Distance is a value that can help determine how effective a class is, and thus allowing it to be compared to other classes.

Transactional Distance is one of the qualitative elements set out as a component of distance learning. In short Transactional Distance is the perceived distance of

individual components in a distance learning class. As of current research into the field of transactional distance it is still a pure qualitative element. Developing a method to measure Transactional Distance would allow a large number of observations of an online class to be correlated to a beneficial effect. In short it would be easier to determine what works.

The goal of this IQP is to further the understanding of Transactional Distance in addition to laying the ground work for a more concrete method of evaluation in web-based distance learning. Beyond there being no method to measure Transactional Distance in a quantitative manner, there are no established methods to measure it at all. Most methods to express Transactional Distance takes place in a binary system of ‘high’ or ‘low’ Transactional Distance. Furthermore the determination of this binary system is linked to other qualitative elements such as class structure.

In order for distance education to benefit from Transactional Distance there must be an understanding of how Transactional Distance can be improved. In order to improve something, there must be a system to tell if it has grown larger or smaller, or in other words a system to measure it. The goal of this IQP is to develop a method to measure Transactional Distance in web-based learning environments.

Chapter 2: Background

Transactional Distance is a qualitative measurement of educational classes, and before any analysis or measurement can be done, the concept must be understood. This chapter explains Transactional Distance as a concept separate from any existing theories. In addition, the evolution of Transactional Distance, as a theory and definition, is provided to convey understanding of how the concept was first created and how it has changed with the growth and development of Distance Education.

2.1 Transactional Distance Explained

Transactional Distance is an abstract theory formulated in an effort to further understand the underlying psychology of Distance Education. The complete theory can be broken down into two separate concepts of Transaction and Distance to help grasp the complete idea. A basic understanding of each part greatly helps comprehension of the entire theory.

2.1.1 Transaction

The initial concept of Transaction as part of Transactional Distance is derived from a work by Dewey (Dewey and Bentley, 1949). The word Transaction is defined as “communication involving two or more people”, and as applied to Transactional Distance it refers to interplay between the learning environment and individuals (Boyd and Apps, 1980).

Throughout the theoretical evolution of Transactional Distance there has always been some form of interaction incumbent in the definition. From Moore’s first definition of Transactional Distance involving dialogue and structure, in which dialogue is the form

of interaction, up to the latest revision by Zhang, where Transactional Distance is broken down into four categories, all of which involve interaction, Transaction as a generalization of individual interactions has been consistently included.

2.1.2 Distance

Distance in online education, as well as Transactional Distance, refers to a distance that is more than a simple geographical separation of student and teacher. Instead this distance is one of understanding and perception. While teacher and student are physically separate from each other, the physical separation leads to a psychological communications gap (Moore 1991). Such a gap can make even the simplest topic a challenge to teach.

2.2 Evolution of Transactional Distance

Transactional Distance as a theory has undergone multiple revisions and changes since its first conception in 1972. One factor contributing to the numerous revisions is changing times and environments. Transactional Distance was first conceived while attempting to develop a theory about Distance Education in 1972 (Moore 1991). At this point in time Distance Education still took the form of correspondence classes, were as in more modern times Distance Education can take place online in web-based environments. Such a shift in environments necessitates a revision of theory to compensate.

2.2.1 Moore's Theory of Transactional Distance

Michael G. Moore was the first person to fully develop a theory of Transactional Distance. The theory began in 1972 during an attempt to create an articulate theory of

Distance Education. This first theory described distance as a psychological communications gap that is a function of the interactions among:

- Structure: refers to elements of a course's design, objectives, activities, assignments, and other elements planned by the instructor.
- Dialogue: extent of communication that occurs during the course.
- Autonomy: the capability of learners to control and manage their learning in a self-reliant manner. (Moore 1973)

At this point in time Moore theorized that the primary influence on Transactional Distance was teacher-learner interaction.

In 1980 Moore slightly revised his theory and named it Transactional Distance. While the definition remained the same, Moore introduced Transactional Distance as a function of only two variables, dialogue and structure. It is worth noting that the actual theory of Transactional Distance in 1980 doesn't include some elements named in the 1973 theory of Distance Education.

2.2.2 Moore's Theory Revised

In 1989 Moore added a new element to his theory. Transactional Distance was now comprised of interaction (previously known as dialogue), course structure, and learner autonomy. Interaction was further broken down into three components: specifically interactions between learner-content, learner-teacher, and learner-learner. Here Moore brings learner-autonomy back into his theory, which was noticeably absent in his 1980 revision.

2.2.3 Saba and Shearer

Saba and Shearer took a different approach to evaluating Transactional Distance in a 1994 research by applying System Dynamics. This approach originated when Saba proposed the system dynamics model as a representation of Transactional Distance in 1988.

Originally Moore had implied that increasing both variables of Dialogue and Structure would reduce Transactional Distance (Moore 1991). However, Saba and Shearer concluded that Dialogue and Structure have an inverse relation (Saba and Shearer 1994). When Dialogue is increased in Distance Education, structure is decreased as well as Transactional Distance. However when Structure increases, Dialogue suffers and correspondingly Transactional Distance increases.

Additionally they determined that Dialogue increases in order to keep the system stable; in other words, Structure alone won't be sufficient. Some teaching styles are completely structure dependant with no room for dialogue. A prime example of this are freshmen lectures. A professor will talk for the allotted time and then leaves without interacting with the audience. There is no dialogue, and following the Saba and Shearer's theory, a very high level of Transactional Distance. Such a purely structural approach is largely ineffective in a web-based environment.

2.2.4 Zhang

The latest revision of Transactional Distance was done by Zhang in 2003 in her doctoral dissertation on transactional distance in web-based environments. At this point in its evolutionary chain the theory of Transactional Distance is comprised entirely of four interactions. Those four interactions include:

- Student and Teacher
- Student and Student
- Student and Content
- Student and Interface

Though Dialogue and Structure are no longer named as main components, this framework is a logical evolution. One can see how interactions between student and teacher and student and student can be summed as Dialogue. Similarly interactions of student and interface can be summed as Structure while student and content falls under the category of Autonomy.

2.3 The Importance of Transactional Distance

Studies of Transactional Distance are aimed at improving the quality of Distance Education courses. As it stands, little is actually known about Transactional Distance, and the percentage of studies done in a web-based environment is very low (Moore 1991) This project attempts to aid in filling some of the gaps in research on Transactional Distance for web-based learning environments.

Chapter 3: Methodology

This project used Zhang's definition as a foundation to develop a method to accurately measure Transactional Distance. Zhang's theory is the most recent revision in the evolutionary chain of Transactional Distance. By its nature, Zhang's definition lends itself to measurement.

Zhang's definition is consists of four separate interactions: Student-Teacher, Student-Student, Student-Content, and Student Interface. Interaction is an activity that can be captured in both quantitative and qualitative measurements. Such interactions as those between Student and Interface can be quantified with the proper software, while other interactions can be measured through student feedback. Each interaction, or Transaction, has an instance in which it occurs and can be tracked.

3.1 Establishing a Method of Measurement

Transactional Distance is a psychological distance, a perceived distance, and not a measurement that can be expressed in 'miles', 'feet', or other established quantified measurements. Further complicating the measurement of Transactional Distance is the fact that the interactions cannot be quantified without potentially skewing the measurement.

As an example, a student is tracked as interacting with fellow classmates five times over a week. The student considers this to be a large amount of interaction, and an indication of low Transactional Distance. The professor who observes this measurement wants students to interact more than ten times a week, and considers this to be a high Transactional Distance. This difference in perception has led the professor into making

an incorrect measurement of Transactional Distance. As such any method of measurement cannot retrieve quantitative data without putting accuracy at risk. Qualitative data is required to make an accurate measurement of Transactional Distance.

3.1.1 Measurement by Survey

Ruling out quantitative data as a means of measurement also rules out most automated measurement systems. Software is not capable of measuring if a student accessed a bulletin board system ‘a little’, or ‘a lot’ over a period of time. Such qualitative perceptions need to be gathered from the student. In order to retrieve identical sets of data from multiple students this project decided to use a survey.

A survey had already been provided to this project in partial fulfillment of other requirements related to the online class used as a sample. This initial survey was prepared by Paula Quinn, further questions were added to the survey specifically targeting Transactional Distance by Professor Lemone. The portion of the survey designed by Paula Quinn targeted student satisfaction (personal communication, October, 2005). See Appendix B for the initial survey.

The web-based class chosen as a test subject for this project was broken down into ten modules. Each module had a reading assignment and written assessment. The survey was administered to all participating students at the end of each module. To encourage participation, students were given points for completing the survey. The surveys were administered to the students through a PHP applet that stored all student responses in a text file.

3.1.2 Formula for Measurement

Transactional Distance will be measured on a qualitative scale: ‘No Transactional Distance’, ‘Low Transactional Distance’, ‘Average Transactional Distance’, ‘High Transactional Distance’. Measurements in this scale will be made by applying data from the surveys on a scale of zero to three. Given that the survey data is quantitative data, zero applies to ‘No Transactional Distance’, the range of zero through one applies to ‘Low Transactional Distance’, and the ranges one through two and two through three apply to the next two levels of Transactional Distance correspondingly.

3.2 The Initial Survey

A survey is a tool used to gather data from many people. The data that a survey gathers is an important aspect, but for this project the initial survey itself also stands as its own form of data. After analyzing the resulting data for a measurement of Transactional Distance, the initial survey will also be analyzed. The accuracy of the initial survey will be determined, and any necessary changes will be identified.

3.2.1 Data Organization

Once the data is fully gathered from all ten modules, the process of extracting information relevant to Transactional Distance will begin. Before isolating the data into a more organized format the fields of data that pertained to a measurement of Transactional Distance will be identified. For ease of manipulation and organization the data found relevant will be placed into Excel spreadsheets and organized into charts and graphs.

The data retrieved by the surveys will be organized in two separate manners. Each module’s survey will be isolated in its own spreadsheets for individual analysis. Data

will also be organized on a long term basis, showing change over the entire course of ten modules.

3.3 Creating a New Survey

As the initial survey used in this project was provided by an external assessment, it was also subjected to an analysis. Both the results of the survey as well as the questions it contains were examined for relevance to Transactional Distance, ease of application to a measurement, and overall usefulness. Any questions on the survey that serve no purpose were discarded, and any other corrections necessary were made. As such this project has proposed a new survey that will better serve a measurement of Transactional Distance.

3.3.1 Design Criteria

While designing the new survey several criteria were kept in mind. The first criterion was applying a unified scale to the survey questions. This is both for the ease of analyzing the survey data as well as for the student completing it. An established scale that is consistent over the questions in the survey will make data analysis easier for future projects. A set scale will also allow the student to approach each question with the same mindset and improve the consistency and accuracy of results.

The second criterion was to create questions that would readily translate into terms of Transactional Distance. Such requirements were first satisfied by removing or rewording all quantitative questions that applied to Transactional Distance on the survey. Second, questions were chosen that specifically target the four interactions defined by Zhang: Student-Teacher, Student-Student, Student-Content, and Student Interface. The

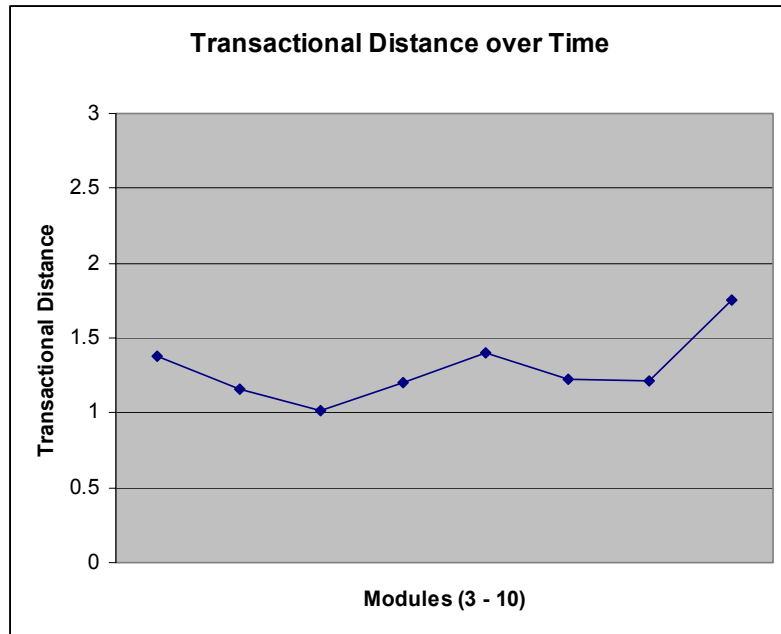
third criterion was to establish that all questions had answers that will limit students to qualitative answers.

Chapter 4: Results & Analysis

The overall goal of this project was to develop a method to measure Transactional Distance. A survey was decided as the tool to gather the data necessary to make the measurement. The following sections contain both the results of the initial survey and a proposed new survey to better measure Transactional Distance.

4.1 Results and Analysis of the Initial Survey

Since the initial survey was given to students to fill out at the end of each academic module, this project was able to gather a measurement for the Transactional Distance of each individual module in



chronological progression as well as a measurement for the entire course. The chart to the right shows the measured progression of Transactional Distance over the course of Modules three through ten. It is noticed that the measurement stays within the bounds for “Average Transactional Distance” as defined in the previous chapter, and that the Transactional Distance was measured highest at the end of the course.

The measurement of Transactional Distance for the overall course also falls within the bounds of “Average Transactional Distance”, with a quantified value of 1.29.

4.1.1 The Questions from the Initial Survey

Transactional Distance is measured as a perceived distance, and measuring a value as perceived by a survey taker requires having questions without any quantitative value. When a survey question with quantitative results is answered, it conveys no relativity to the person analyzing the data. Two students could both report working on a module for five hours, but one student felt he spent an excessive amount of time, and the other student felt that he spent a very little amount of time. The person analyzing the survey cannot draw these conclusions from quantitative data.

All questions contained in this section are drawn from the initial survey which can be referenced in Appendix B. The questions analyzed in the following sections are only those pertinent to Transactional Distance and not the full number present on the survey.

4.1.1.1 Question 2 – Course Staff

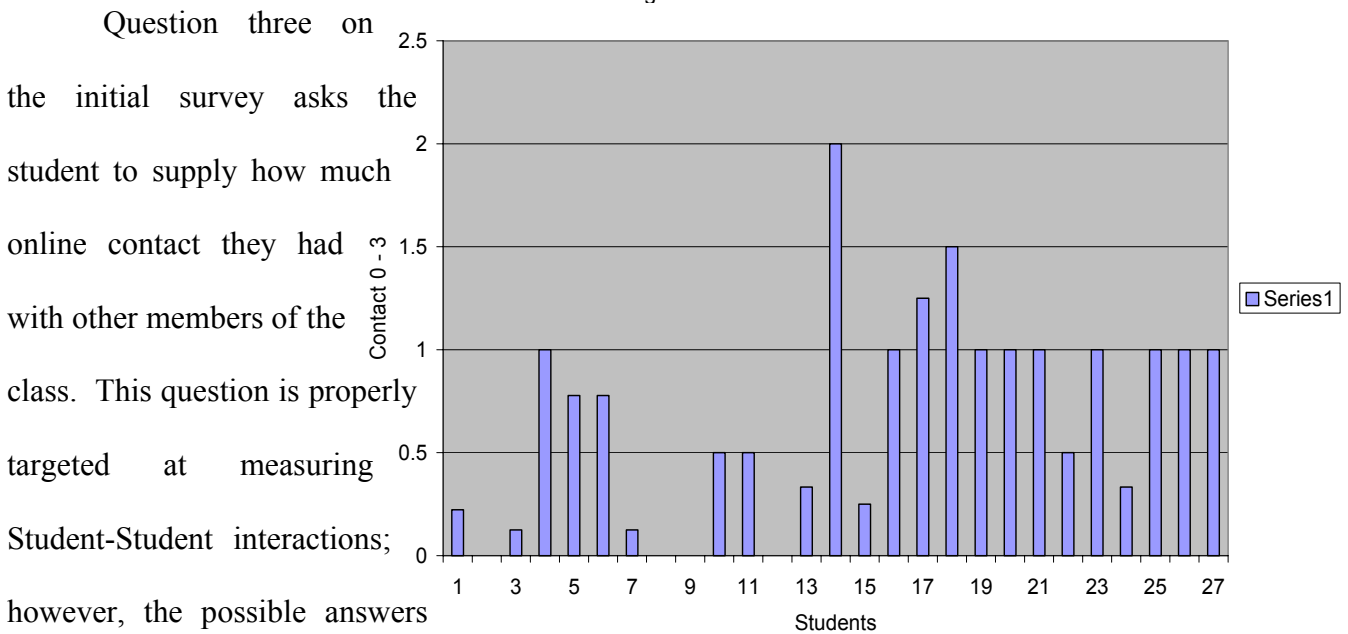
Question number two asks if any interaction with the course staff was helpful strictly in relation to the Bulletin Board. The answer to this question does not provide an adequate measure of interaction and provides no aid to an evaluation of Transactional Distance. This stems from the fact that it does not provide an adequate scale of measurement for any of the four categories of interaction, Student-Student, Student-Teacher, Student-Content, and Student-Interface. However, it does measure Student-Teacher interaction on a Boolean basis; there was interaction, or there wasn't. Students answering this question were provided four options to convey the level of help they received, and one to convey that no help was sought. The different options provide

distinction for the perceived quality of help, but not the perceived quantity, and that is a distinction that hasn't been made yet in the definition of Transactional Distance.

As already stated, a part of Transactional Distance is interaction between Student and Teacher. However, the persona of Teacher should include all bodies of instruction pertinent to the course. This question does maintain this aspect by asking the student about 'Course Staff'. This is a generalization that could include the Professor, TA's, and any other staff. This question needs to be restructured to ask about the perceived quantity of interaction between the Student and all personas included in the category of Teacher.

4.1.1.2 Question 3 – Online Contact

Figure 2: Student – Student Online Contact



to this question deviate from others by only providing three possible answers. These answers are 'None', 'A Little', and 'A Lot'. Figure 2 above contains the average online contact for each student over the course of the test class. As easily seen the majority of students report 'A little' online contact, which is reflected by the range of 0 – 1.

As shown by the chart above, there is very little variation in the results. Most students consistently put themselves down for ‘A little’ online contact and only three out of twenty seven students broke that barrier. Some of the concerns that need to be addressed about this question are the apparent lack of variation among the student’s answers as well as the fact that the range offered for student feedback is based on a different scale than the other questions on the survey.

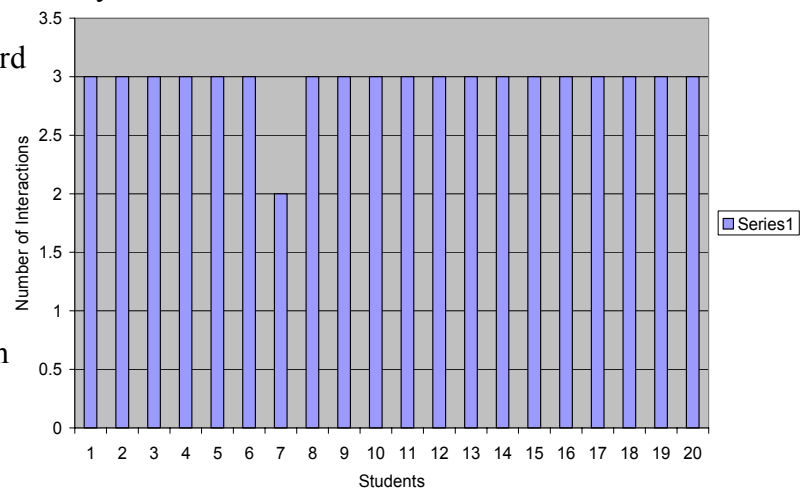
4.1.1.3 Question 7 – The Background Reading

Question seven asks the student to relate how helpful the background reading was and provides five potential answers that range through ‘not helpful’ to ‘very helpful’. As already cited, Transactional Distance is a psychological distance; the larger it is, the greater the room for misunderstanding. Asking the student how helpful the material was is excellent for improving the course, but flawed at measuring Transactional Distance. Information yielded by this question was not included in the formula for measuring Transactional Distance by this project. However, this question is the predecessor for questions Five and Six on the new survey.

4.1.1.4 Question 10 – Accessing the Bulletin Board

Question ten asks the student how many times they accessed the bulletin board supplied for the class during each module. The possible answers to this survey were limited to a selection of ‘None’, ‘1’, ‘2’, or ‘More than 2’. Figure 3 is a graph from

Figure 3: Interaction Between Student and BB



the answers to this question from Module Five, and is consistent with how this question was answered over all ten modules. The ceiling for this question was set too low by the provided answers, and as such prevents an accurate reading for Transactional Distance.

4.1.1.5 Questions 11 – 14

Questions eleven through fourteen closely mirror question ten in format; they all have the same answer set. While these questions, including question ten, are directly targeted to the interactions between Student-Student (questions 10 and 11), Student-Interface (questions 10, 11, 12, and 14), and Student-Content (question 13), they all gather quantitative data. It was necessary to use this information to provide the measurement of Transactional Distance seen at the beginning of section 4.1.

4.1.2 General Issues

The initial survey does not do an adequate job providing information that can be easily adapted to a measurement of Transactional Distance. Again, keeping in mind that Transactional Distance is a perceived measurement, the initial survey takes the wrong approach by asking a lot of quantitative questions. Furthermore, several categories of interaction needed for a full measurement of Transactional Distance were only capable of being evaluated from quantitative data. As such this project had to put its own scale on the data that may not coincide with the student's individual scale.

4.2 New Survey

Part of this project's goals was to create a new survey that would fix the inadequacies of the initial survey.

4.2.1 New Survey Questions

The following are the redesigned survey questions to measure Transactional Distance. The full revised survey can be found in Appendix C. All questions have the same range of answers, so they are only displayed on the first survey question. Some questions may need to be re-worded depending on the structure of the course they are being administered to.

1. How much contact did you have with the Professor(s), TA(s), and other Course Staff?
 None
 A Little
 Some
 A Lot
2. In your opinion, how much contact, online or otherwise, did you have with fellow class members?
3. How much did you access the BB?
4. How much time did you spend with the Course Management System?
5. How much time did you spend preparing for assessments (Homework, tests)?
6. What level of understanding did you take from the course material?

4.2.1.1 Question 1

How much contact did you have with the Professor(s), TA(s), and other Course Staff?

Question one is strictly a measurement of Student-Teacher interaction. It asks for the perceived amount of interaction in a measurement that can easily be applied to Transactional Distance.

4.2.1.2 Question 2

In your opinion, how much contact, online or otherwise, did you have with fellow class members?

Question two is one of two questions that will be applied to the measurement of Student-Student interactions. It is designed to gather the perceived amount of contact a student had with fellow classmates.

4.2.1.3 Question 3

How much did you access the BB?

Question three is capable of providing up to three different measurements depending on the involvement of the course staff. First it will provide a measurement for Student-Interface interactions. It can also be counted in Student-Student interactions, as students should be encouraged to reply to each other and Bulletin Boards are strictly a medium of communication. Third, if the course staff is answering questions on the bulletin board this question can be applied to a measurement of Student-Teacher interactions.

4.2.1.4 Question 4

How much time did you spend with the Course Management System?

Question four is strictly a measurement of Student-Interface interaction. It is designed to retrieve the perceived amount of interaction from the student. However, depending on the design of the course, for example if all content is stored in the portal, this question could also provide a measurement for Student-Content interactions. However, such a measurement would be highly dependant on course structure.

4.2.1.5 Question 5

How much time did you spend preparing for assessments (Homework, tests)?

Question five is designed to measure Student-Content interactions. This question assumes that all forms of preparation involve class content in one manner or another. As such this question should evaluate the entirety of such interaction.

4.2.1.6 Question 6

What level of understanding did you take from the course material?

Question six also measures Student-Content interactions. The larger the Transactional Distance, the more room there is for misunderstanding. As such a rough estimate of Transactional Distance can be gained by the amount of misunderstanding that occurs.

Chapter 5: Conclusion

This project was designed to develop a method to measure Transactional Distance in web-based learning environments. Measurement was accomplished through means of a survey provided to students over the course of a web-based class. This measurement was done to the highest accuracy possible with the data provided by the initial survey, which had not been designed with an established definition of Transactional Distance in mind. As such a majority of the data was quantitative, and since Transactional Distance is a psychological distance that requires qualitative data to maintain a scale between observers, this data adds inaccuracy to the measurement of Transactional Distance. This can be seen in questions ten through fourteen on the initial survey in that quantitative data was gathered where qualitative data was needed.

Upon achieving the measurement of Transactional Distance, the survey itself was examined and analyzed. Design flaws apparent in the initial survey were addressed and compensated for in a new survey. The new survey was designed to retrieve data more relevant to Transactional Distance with questions phrased to convey the question more accurately. Data from the redesigned survey will be able to create a more accurate measurement.

5.1 Conclusions

This project successfully measured Transactional Distance in a web-based learning environment, in addition to proposing an improved method of doing so. As previously determined, quantitative data is not useful for determining Transactional Distance. Quantified data can easily be interpreted differently by different people depending on their personal sense of scale. One million dollars is a very different sum to

a poor college student than it is to a billionaire. One may view the sum as ‘A Lot’ of money, while the other labels it as ‘A Little’.

By measuring Transactional Distance through a survey delivered multiple times over the duration of a class it is possible to notice if the distance is increasing or decreasing over time. This also opens the possibility of viewing how other outside stimuli affect Transactional Distance. Will a harder section of a course bring students together to collaborate? Is the fact that students may collaborate more under such stimuli lowering the Transactional Distance, or will the increased interaction be offset by a lack of understanding?

5.2 Possibilities for Future Research

Though this project has successfully measured the Transactional Distance of a web-based class, and proposed a survey to improve the accuracy of a measurement, there are several directions future research on this topic could take.

5.2.1 Re-evaluation of the New Survey

This project can essentially be repeated using the new survey proposed within as an initial survey. An evaluation of the new survey would establish whether it is an accurate tool to measure Transactional Distance, as this project was unable to do more to than to propose changes.

5.2.2 Expanding the New Survey

The new survey put forward by this project only contains seven questions that are used to measure Transactional Distance. It is possible that there are more elements of an online class that could be measured to create a more accurate assessment of Transactional

Distance. A future project could evaluate the new survey and determine if any additional questions need to be added to improve accuracy.

5.2.3 Creating a Controlled Test

In order to test the accuracy of the new survey proposed in this project, two web-based distance education classes could be designed around the principles of Transactional Distance, one for high levels and one for low levels of Transactional Distance. Two classes would be designed, one for high levels and one for low levels of Transactional Distance. By designing these classes towards a particular level of Transactional Distance, it would be possible to check the results of the survey for accuracy. If the survey reports low Transactional Distance for the high level class, it would suggest inaccuracies in the survey.

It has been theorized that high levels of Transactional Distance hinder learning and performance in education; as such this project would need to be conducted in a similar manner to clinical studies. Students would need to be informed they were taking part in a study and that one class would be designed to have high amounts of Transactional Distance. Unless informed and willing students were taking part, designing a class with high levels of Transactional Distance in mind would not be ethical. This study would also be better done at a continuing education level, or any class that is not being taken paid for or taken for credit.

5.2.3.1 A More Ethical Approach

A less ethically controversial method would involve designing two classes around the required amount of interaction. One class would be directed towards frequent

interaction, and one class would be pushed towards solitary work and a lack of interaction. Separate measurements of Transactional Distance could be taken of these classes in an attempt to verify the accuracy of the survey.

However, mincing around the ethical tree will only convolute and cloud methods to verify the accurateness of the new survey. The only way to say “Yes that is right!” is if the results have been predetermined.

5.2.4 Examining Quality vs. Quantity

This project did not find any distinction between quality and quantity of interactions in relation to Transactional Distance while examining previous work in the field. Further research could be conducted on the effect that quality of interaction has on Transactional Distance and determine if questions measuring quality should be added to the survey.

Chapter 6: Bibliography

Transactional Distance Theory (n.d.) Retrieved June, 2005, from

<http://cde.athabascau.ca/cmc/transactional.html>

Steven Barrett (2002). Overcoming Transactional Distance as a Barrier to Effective Communication over the Internet [Electronic version]. *International Education Journal* Retrieved June, 2005, from <http://ehlt.flinders.edu.au/education/iej/articles/v3n4/barrett/paper.pdf>

Michael G. Moore (1991). Editorial – Distance Education Theory[Electronic Version]. *The American Journal of Distance Education* Retrieved June, 2005 from http://www.ajde.com/Contents/vol5_3.htm

Toni Steffensen Pauls (2003) The Importance of Interaction in Online Courses. Retrieved June, 2005 from http://www.olin.org/conferences/OLN2003/papers/Importance_of_interactivity_in_Distance_Education_1.pdf

David S. Stein, Constance E. Wanstreet, Jennifer Calvin, Christine Overtoom, and Joe E. Wheaton (2005). Bridging the Transactional Distance Gap in Online Learning Environments. *The American Journal of Distance Education*, 19(2), 104-118.

Farhad Saba, Rick L. Shearer (1994). Verifying Key Theoretical Concepts in a Dynamic Model of Distance Education. *The American Journal of Distance Education*, 8(1), 36-59.



Appendices

Of

Measuring Transactional Distance in
Web-based Learning Environments

Appendix A: Annotated Bibliography

Transactional Distance Theory (n.d.) Retrieved June, 2005, from

<http://cde.athabascau.ca/cmc/transactional.html>

This article is a sort summation of what transactional distance is as defined Martindale. It briefly mentions Michael G. Moore, and has a large quote from Martindale.

Steven Barrett (2002). Overcoming Transactional Distance as a Barrier to Effective Communication over the Internet [Electronic version]. *International Education Journal* Retrieved June, 2005, from <http://ehlt.flinders.edu.au/education/iej/articles/v3n4/barrett/paper.pdf>

This is an international journal. It does a good job explaining some of the basics of Transactional Distance and also provides a list of methods the author believes can be used to overcome transactional distance.

Michael G. Moore (1991). Editorial – Distance Education Theory[Electronic Version]. *The American Journal of Distance Education* Retrieved June, 2005 from http://www.ajde.com/Contents/vol5_3.htm

This is an editorial written by Michael G. Moore. It does an excellent job providing a summary of Moore's theories of Transactional Distance, giving a brief history of where his theories started and how they evolved.

Toni Steffensen Pauls (2003) The Importance of Interaction in Online Courses. Retrieved June, 2005 from http://www.oln.org/conferences/OLN2003/papers/Importance_of_interactivity_in_Distance_Education_1.pdf

This paper discusses the history of distance education as well as methods to increase interaction. It raises multiple ways of increasing interaction in web-based environments as tools to improve student performance. It does not tie Transactional Distance and interactions together.

David S. Stein, Constance E. Wanstreet, Jennifer Calvin, Christine Overtoom, and Joe E. Wheaton (2005). Bridging the Transactional Distance Gap in Online Learning Environments. *The American Journal of Distance Education*, 19(2), 104-118.

A study on perceived knowledge gained as a function of learner satisfaction with course structure. The study was based on Moore's theory of Transactional Distance and draws conclusions on learner satisfaction, structure and interaction.

Farhad Saba, Rick L. Shearer (1994). Verifying Key Theoretical Concepts in a Dynamic Model of Distance Education. *The American Journal of Distance Education*, 8(1), 36-59.

This is a research paper on applying a system dynamics approach to the theory of Transactional Distance in relation to structure and dialogue. This paper draws conclusions on how dialogue and structure affect each other in terms of Transactional Distance.

Appendix B: The Initial Survey

CS 503 Module <Insert Module Number> Survey

Do not do this assessment until you are completely done with Module 10 including having submitted the homework and looked at (and listened to) the ppt solutions

Part 1

Teaching Technology Fellowship evaluation measures the effects course improvements (animation, audio, video) have on students

1. Demographics

There are **2** questions to answer.

1. Your name:

2. Are you:

From WPI

From KU

2. Course Improvements

There are **6** questions to answer.

1. How many times did you go back to Module 0 and access the Animation of Mathematical Induction?

0

1

2

More than 2

2. How many times did you access the ppt homework solutions?

0 (Then do not do the survey yet)

1

2

More than 2

3. How would you rate the video quality of the ppt Animation?

very poor

poor

neither poor nor good

good

very good

4. How would you rate the audio quality of the ppt Animation?

very poor

poor

- neither poor nor good
 - good
 - very good
5. How useful were the ppt homework solutions in helping you to understand the material better?
 - not at all useful
 - not very useful
 - neither not useful nor useful
 - useful
 - very useful
 6. How useful was the audio in the ppt homework solutions?
 - not at all helpful
 - not very helpful
 - neither not helpful nor helpful
 - helpful
 - very helpful

Part 2

Transactional Distance measures the psychological distance students experience with other students, the instructors, the content and the interface.

There are **21** questions to answer.

1. How much time did you spend on Module 10?
 - Less than 3 hours
 - 3-5 hours
 - 6-10 hours
 - 11-15 hours
 - 16-20 hours
 - 20+ hours
2. How helpful was the course staff in answering your questions on the bb for this module ?
 - not at all helpful
 - not very helpful
 - did not have any questions
 - helpful
 - very helpful
3. How much contact online did you have with fellow class members ?
 - none
 - a little
 - a lot
4. Did you post to the bb?
 - yes
 - no
5. Did you answer a question or reply to someone on the bb?
 - yes

- no
 - there was nothing to reply to
6. How helpful was the chat room session?
- not at all helpful
 - not very helpful
 - did not have a chat room session or unable to attend
 - helpful
 - very helpful
7. How helpful was the background reading?
- not at all helpful
 - not very helpful
 - either not helpful nor helpful
 - helpful
 - very helpful
8. Did you search the web for supplementary material?
- yes
 - no
9. How helpful were the bb postings?
- not at all helpful
 - not very helpful
 - neither not helpful nor helpful
 - helpful
 - very helpful
 - did not read the bb
10. How many times did you access the bb?
- 0
 - 1
 - 2
 - More than 2
11. How many times did you enter the chat room?
- 0
 - 1
 - 2
 - More than 2
12. How many times did you access your grades?
- 0
 - 1
 - 2
 - More than 2
13. How many times did you access the background reading?
- 0
 - 1
 - 2
 - More than 2
14. How many times did you use the File Exchange?
- 0

- 1
 - 2
 - More than 2
15. The material in the module was:
- very difficult
 - difficult
 - neither difficult nor easy
 - easy
 - very easy
16. Did you have enough time for this module?
- yes
 - no
17. Did you need to talk to a live person (besides a classmate) face-to-face in order to do this Module?
- yes
 - no
18. Where can you access the course site from? (Check all that apply)
- from school
 - from home
 - from work
 - from a friends
 - from an internet cafe
 - others
19. If others, please specify:
20. What question(s) do you wish I had asked?
21. Other comments (Please do not hesitate!)

Appendix C: The New Survey

Revised Survey

Part 1

General questions to measure course effectiveness and areas that need improvement.

22. How much time did you spend on Module 10?
- Less than 3 hours
 - 3-5 hours
 - 6-10 hours
 - 11-15 hours
 - 16-20 hours
 - 20+ hours
23. How helpful was the course staff in answering your questions for this module ?
- did not have any questions
 - not at all helpful
 - not very helpful
 - helpful
 - very helpful
24. Did you post to the bb?
- yes
 - no
25. Did you answer a question or reply to someone on the bb?
- yes
 - no
 - there was nothing to reply to
26. How helpful was the chat room session?
- not at all helpful
 - not very helpful
 - did not have a chat room session or unable to attend
 - helpful
 - very helpful
27. How helpful was the background reading?
- not at all helpful
 - not very helpful
 - either not helpful nor helpful
 - helpful
 - very helpful
28. Did you search the web for supplementary material?
- yes
 - no

- Some
 - A Lot
10. How much time did you spend with the Course Management System?
- None
 - A Little
 - Some
 - A Lot
11. How much time did you spend preparing for assessments (Homework, tests)?
- None
 - A Little
 - Some
 - A Lot
12. What level of understanding did you take from the course material?
- None
 - A Little
 - Some
 - A Lot

Appendix D: Initial Survey Data

Legend

Location:

Question 2 from the Demographics Section

1 = WPI

0 = KU

Grade:

Score out of 50

Hours Spent/Time:

Question 1 from Part 2: How much time did you spend on Module <insert number>?

2 = Less than 3 hours

3 = 3 – 5 hours

6 = 6 – 10 hours

11 = 11 – 16 hours

16 = 16 – 20 hours

20 = 20 or more hours

Online Contact:

Question 3 from Part 2: How much contact online did you have with fellow class members?

0 = None

1 = A little

2 = Some

3 = A lot

BB Loads: How many times did you access the bb?

0 = 0

1 = 1

2 = 2

3 = More than 2

Useful BB: How helpful were the bb postings?

-1 = did not read

0 = not at all helpful

1 = not very helpful

2 = Neither not helpful nor helpful

3 = helpful

4 = very helpful

Difficulty of mod: The material in the module was?

Very difficult

Difficult

Neither difficult nor easy

Easy

Very easy

Survey 2

	Loc	Score	Hours Spent	online contact	# BB loads	useful BB	
Student 1	1	47	3	0	3		0
Student 2	1	47	3	0	2		3
Student 3	1	45	6	1	3		2
Student 4	1	48	6	0	3		4
Student 5	0	36	6	1	3		3
Student 6	1	48	6	0	3		3
Student 7	1	46	6	1	3		3
Student 8	0	39	3	1	1		
Student 9	1	48	6	0	3		1
Student 10	1	40	3	0	3		3
Student 11	1	47	6	1	3		3
Student 12	1	49	11	0	3		3
Student 13	0	36	6	2	3		3
Student 14	0	40	6	0	2		3
Student 15	0	39		0	3		2
Student 16	0	36	3	1	3		1
Student 17	0	39	3	1			3
Student 18	0	36	3	1	3		3
Student 19	0	36	2	2	2		2
Student 20	0	36	2	2	3		3
Student 21	0	36	6	1	1		3
Student 22	0	36	6	1	3		3
Student 23	0	39	3	1	1		3
Student 24	0	36	3	1	2		4

Survey 3

	Loc	Grade	Time	online contact	# BB loads	useful BB	difficultly of mod
Student 1	1	50	11	0	3	1	difficult
Student 2	1	50	6	0	3	3	neither_difficult_nor_easy
Student 3	1	50	3	0	3	3	neither_difficult_nor_easy
Student 4	1	48	3	3	3	0	neither_difficult_nor_easy
Student 5	1	43	11	1	3	3	difficult
Student 6	1	43	6	0	3	3	neither_difficult_nor_easy
Student 7	0	42	16	0	2	-1	neither_difficult_nor_easy
Student 8	0	41	6	1	2	3	difficult
Student 9	0	41	6	1	3	4	neither_difficult_nor_easy
Student 10	0	41	6	3	3	3	difficult
Student 11	0	41	6	1	3	3	neither_difficult_nor_easy
Student 12	0	41	6	0	3	3	difficult
Student 13	0	39	6	1	3	3	neither_difficult_nor_easy
Student 14	0	39	6	1	1	4	neither_difficult_nor_easy
Student 15	0	39	3	1	2	-1	difficult
Student 16	0	39	2	0	3	3	easy
Student 17	0	39	2	1	2	3	neither_difficult_nor_easy
Student 18	1	35	6	0	3	1	difficult
Student 19	1	35	11	1	3	3	difficult
Student 20	0	35	3	1	3	0	neither_difficult_nor_easy
Student 21	0	35	3	1	3	4	difficult
Student 22	0	35	3	1		3	neither_difficult_nor_easy
Student 23	0	35	6	0	3	1	difficult
Student 24	0	35	3	0	3	4	difficult
Student 25	1	31	0	0	3	1	difficult
Student 26	1	30	6	0	3	3	neither_difficult_nor_easy

Survey 4

	Loc	Grade	Time	online contact	# loads	BB useful BB	difficultly of mod
Student 1	1	48	11	0	3	4	very_difficult
Student 2	1	47	11	0	3	4	difficult
Student 3	1	47	3	0	3	3	difficult
Student 4	1	47	6	0	3	3	difficult
Student 5	1	46	11	0	3	3	neither_difficult_nor_easy
Student 6	1	45	11	0	3	3	very_difficult
Student 7	1	45	11	0	3	3	difficult
Student 8	1	44	11	1	3	3	difficult
Student 9	1	43	16	1	3	3	difficult
Student 10	1	43	11	0	2	1	difficult

Survey 5

	Loc	Grade	Time	online contact	# loads	BB useful BB	difficultly of mod
Student 1	0	36	20	1	3	4	neither_difficult_nor_easy
Student 2	0	36	6	1	3	4	neither_difficult_nor_easy
Student 3	0	36	6	1	3	4	neither_difficult_nor_easy
Student 4	1	50	6	0	3	4	neither_difficult_nor_easy
Student 5	0	36	6	1	3	3	neither_difficult_nor_easy
Student 6	0	36	6	1	3	3	neither_difficult_nor_easy
Student 7	0	36	6	1	2	3	neither_difficult_nor_easy
Student 8	0	36	3	1	3	3	neither_difficult_nor_easy
Student 9	0	36	3	0	3	3	neither_difficult_nor_easy
Student 10	1	47	6	1	3	1	neither_difficult_nor_easy
Student 11	1	45	6	1	3	1	neither_difficult_nor_easy
Student 12	1	43	6	0	3	3	easy
Student 13	0	36	3	0	3	3	easy
Student 14	1	45	16	0	3	4	difficult
Student 15	1	48	6	0	3	4	difficult
Student 16	0	36	11	3	3	3	difficult
Student 17	1	49	11	1	3	3	difficult
Student 18	0	0	6	1	3	3	difficult
Student 19	0	36	6	0	3	3	difficult
Student 20	0	36	6	0	3	3	difficult

Survey 6

	Loc	Grade	Time	online contact	# loads	BB	useful BB	difficulty of mod
Student 1	1	48	16	1	3	3	4	very_difficult
Student 2	0	41	11	0	3	3	3	very_difficult
Student 3	0	48	20	1	3	3	4	neither_difficult_nor_easy
Student 4	0	39	3	1	3	3	3	neither_difficult_nor_easy
Student 5	0	48	16	0	3	3	3	neither_difficult_nor_easy
Student 6	1	44	11	0	3	3	3	neither_difficult_nor_easy
Student 7	1	48	6	1	3	3	1	neither_difficult_nor_easy
Student 8	0	41	6	1	3	3	4	easy
Student 9	0	41	6	3	3	3	4	difficult
Student 10	0	41	11	1	3	3	4	difficult
Student 11	1	50	6	0	3	3	4	difficult
Student 12	1	50	16	1	3	3	3	difficult
Student 13	0	41	6	1	3	3	3	difficult
Student 14	1	48	20	0	3	3	3	difficult
Student 15	1	50	11	0	3	3	3	difficult
Student 16	1	44	11	0	3	3	3	difficult
Student 17	1	44	6	0	3	3	3	difficult
Student 18	0	45	20	1	3	3	1	difficult
Student 19	1	46	11	0	3	3	1	difficult
Student 20	0	39	6	0	3	3	1	difficult

Survey 7

	Loc	Grade	Time	online contact	# loads	BB	useful BB	difficulty of mod
Student 1	1	49	11	0	3	3	4	difficult
Student 2	1	39	3	0	3	3	3	difficult
Student 3	1	46	6	1	3	3	3	neither_difficult_nor_easy
Student 4	1	38	6	0	3	3	3	easy
Student 5	1	50	16	1	3	3	3	difficult
Student 6	1	48	11	0	3	3	1	neither_difficult_nor_easy
Student 7	1	50	6	1	3	3	1	neither_difficult_nor_easy
Student 8	1	45	11	0	3	3	3	difficult
Student 9	1	44	11	1	3	3	4	neither_difficult_nor_easy
Student 10	1	46	11	0	3	3	3	neither_difficult_nor_easy

Survey 8

	Loc	Grade	Time	online contact	# loads	BB	useful BB	difficultly of mod
Student 1	1	50	11	0	3	3	3	difficult
Student 2	1	50	20	1	3	4	4	difficult
Student 3	1	49	6	1	3	0	0	neither_difficult_nor_easy
Student 4	1	49	6	0	3	3	3	neither_difficult_nor_easy
Student 5	1	48	6	0	3	4	4	difficult
Student 6	1	48	11	1	3	3	3	neither_difficult_nor_easy
Student 7	1	45	16	0	3	3	3	difficult
Student 8	1	45	16	1	3	3	3	difficult
Student 9	1	45	6	0	3	0	0	difficult
Student 10	1	0	11	0	3	1	1	difficult

Survey 9

	Loc	Grade	Time	online contact	# loads	BB	useful BB	difficultly of mod
Student 1	1	50	11	1	3	3	3	very_difficult
Student 2	1	48	16	1	3	3	3	very_difficult
Student 3	1	48	20	0	3	3	3	very_difficult
Student 4	1	43	20	1	3	4	4	very_difficult
Student 5	1	42	6	0	3	4	4	very_difficult
Student 6	1	41	6	1	3	0	0	very_difficult
Student 7	1	40	6	0	3	0	0	very_difficult
Student 8	1	33	6	0	3	3	3	difficult
Student 9	1	20	6	0	3	0	0	difficult
Student 10	1	0	6	0	3	3	3	neither_difficult_nor_easy
Student 11	1	0	11	1	3	4	4	neither_difficult_nor_easy
Student 12	1	0	11	0	0	-1	-1	difficult

Survey 10

	Loc	Grade	Time	online contact	# loads	BB	useful BB	difficultly of mod
Student 1	1	50	6	1	3	1	1	neither_difficult_nor_easy
Student 2	1	50	11	1	3	3	3	difficult
Student 3	1	48	6	0	3	0	0	easy
Student 4	1	48	11	1	3	3	3	neither_difficult_nor_easy
Student 5	1	46	11	0	0	-1	-1	difficult
Student 6	1	45	3	0	3	1	1	difficult
Student 7	1	41	3	0	3	3	3	easy
Student 8	1	0	3	0	3	1	1	difficult
Student 9	1	0	11	1	3	4	4	neither_difficult_nor_easy