1 Introduction

The ways in which social media and other online tools are used to facilitate various types of interaction in teaching and learning situations have been looked at by many professionals. The hypothesis here is that these applications are able to be classified into groups which represent similar kinds of interaction. This could help to identify alternative ways of facilitating a particular activity.

There is a University project called TREE (Technology Resources for Educational Enhancement) which is intended to help people find social media tools suitable for their teaching requirements. It has been developed by IS (Information Services) within the University of Edinburgh. TREE is currently in its BETA phase which means that while fully functional and ready for use, there is space for further improvement. The problem with this service is that it starts with the tool rather than starting with the requirements and demonstrating the similarity between different tool has to be done manually. Thus, this project can make a great contribution to develop this service [6].

12 semi-structured interviews were held with teaching staff across a range of disciplines in the University of Edinburgh, and transcribed (discarding their identification). The interview transcripts show a wide range of examples and all 12 staff members across the University had a wide range of experience in using online tool. The main goal of these interviews was to find out what sorts of tools do people use and what is the reason for using them and how are they using them. The interviews also tried to discover weather people had an explicit pedagogical aim for any of these uses and what kinds of interactions are involved. Because it is needed to be known weather the model we chose has the ability to represent all possible interactions or not. These member also have been asked to explain what tools worked for them and what tools did not work for them and what were the problems of the different tools they use. The last aim of these interviews was to find out weather there is anything that people would like to do with a tool which they have not been able to do yet. A summarized version of these interviews can be observed in figure (1).

A process calculus can be used to model the interactions. Modelling the interactions in a process calculus allows the interactions to be compared and classified (Robin Milner 1980). The process calculus used in this project is the Calculus of Communicating Systems (CCS) which is fairly a suitable language for representing different kinds of interactions (section 2.3). The aim of this project is to take some real examples from the interview transcripts and to model those in a similar way. From this, we would investigate whether similar models really did represent practical alternative solutions, and if not, what others factors need to be considered and modelled.

In this project, I attempted to demonstrate the others factors need to be considered in order for
the similar models to represent practical alternative solutions. I have attempted to discover the possibility to include these factors into the model somehow, and if it is possible to model them, how can they be included in the model and what would be the best way to change the model to represent those extra factors. The tasks I have performed for this project are divided into 5 steps:

2. Studying and analysing the interview transcripts on the university staff members.
3. Extracting a set of extra factors from the interview transcripts and the analysing the possibility to include them into the model.
4. Applying the extra factors into the model and attempting to express them in CCS.
5. Listing the pedagogical aims for using each tool and interactions.

2 Background

2.1 Classifying interaction

The first classification and interaction representation that was attempted is a very simple representation. The idea behind this representation is who is communication with whom and what is the order of communication. The message content of the interaction is not considered as a factor in this representation. Couple of examples have been illustrated in figure (2).
Figure 2: A simple representation of interactions. S: Student. T: Tutor. In model C, labels a, b, and c mean that the message content is different for every student.
As it can be seen from figure (2), the model is quite straightforward. For example, model A represents an email exchange between a student and a tutor, or an individual tutorial, model B represents a lecture or a video, model C represents individual feedback given to students, and model D can represent a tutorial in Skype. Couple of the social media tools used for teaching is shown in the table below along with the models which represent them. An important fact to consider is that a tool does not necessarily fall into one of these models. In other words, several interaction models might be able to represent one social media tool. For example, an interaction in Skype can be presented by both model A and model B. It depends on the number of people in the interaction.

<table>
<thead>
<tr>
<th></th>
<th>Skype</th>
<th>Individual Feedback</th>
<th>1-to-1 tutorial</th>
<th>Online videos</th>
<th>Clickers</th>
<th>Presentations</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model A</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Model B</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Model C</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model D</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

### 2.2 Modelling and equivalency

These interactions need to be represented in a way so that it is possible to reason about them. Also, the model must be able to represent a sequence of actions such as a student asking a question following by receiving an answer. One important factor that must be considered is the significance of the message content compared to the actual actions. For example, which aspect is more important when a student asks a question following by receiving an answer? The action sequence of asking the question and receiving the answer or the actual content of the question and answer.

Another important aspect of modelling these interactions is equivalency. It needs to be decided in advance that what are the conditions in which two interactions are equivalence. For example, if four students are communicating with each other using Skype or they are chatting using Google-Hangout, are these two interactions the same? They both can be represented by model A in figure (2). However one of them is an interaction in text and the other one is a face-to-face interaction. Thus, the factors that are able to make two interaction equivalence need to be determined in advance by the model designer. An important to remember is that tools supporting the same kinds of interactions should be suitable for similar purposes.

A reaction systems seems suitable for modelling interactions in social media. A reactive system is a system that responds (reacts) to external events (Wieringa, 2003). It has states and it influence the environment by reacting to those external events. The term is used primarily for describing human-made systems. For example, a light consisting of a bulb and a switch is a reactive system, reacting to the user changing the switch position. Process algebra are prototype specification languages for reactive systems. Process calculi (or process algebras) are a diverse family of related approaches for formally modelling concurrent systems. Process calculi provide a tool for the high-level description of interactions, communications, and synchronizations between a collection of independent agents or processes (Beaten, 2004). They also provide algebraic laws that allow process descriptions to be manipulated and analysed, and permit formal reasoning about equivalences between processes. Leading examples of process calculi include CSP, CCS, and LOTOS.
2.3 CCS

In this project, CCS was chosen as the process calculus to model social media interactions. The Calculus of Communicating Systems (CCS) is a process calculus introduced by Robin Milner around 1980 the title of a book describing the calculus (Milner, 1980). Its actions model indivisible communications between exactly two participants. The formal language includes primitives for describing parallel composition, choice between actions and scope restriction.

According to Milner, "There is nothing canonical about the choice of the basic combinators, even though they were chosen with great attention to economy. What characterises our calculus is not the exact choice of combinators, but rather the choice of interpretation and of mathematical framework". The expressions of the language are interpreted as a labelled transition system. There are two aspects that needs to be defined in CCS: process and communication. A process can be described as a black box with inputs and outputs and a communication is an information exchange between a "matching" input and output. When a process follows a communication, it evolves into a different process. Given that 'P1' and 'P2' are processes and 'a' is a communication, a set of CCS processes syntax is shows in the table below:

<table>
<thead>
<tr>
<th>Syntax</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1 = a.Ø</td>
<td>Ø is the null process (stopped-end of interaction). The process P1 stops after performing 'a'</td>
</tr>
<tr>
<td>P1 = a.P1</td>
<td>The process P1 can perform action 'a' and continue as the process P1</td>
</tr>
<tr>
<td>P1 + P2</td>
<td>The process P1 + P2 can proceed either as the process P1 or the process P2.</td>
</tr>
<tr>
<td>P1</td>
<td>P2</td>
</tr>
</tbody>
</table>

Several examples are provided below for the case of interaction in teaching areas for each of the grammar rules above. In example 2, 3, and 4, it is possible to write 'question' and 'answer' instead of q(X) and a(X). The reason that these actions are being represented as a function is the message content. In other words, if an student ask a question X, he would like to revive an answer to the same question and not a different question.

1. Video = show.Video
   Student1 = show.Ø
   Student2 = show.Ø

   After showing, the video returns to the same process as it started. The overbar in show means that the action results in an output. Each student watches it only once and then stop.

2. Demonstrator = q(X).a(X).Demonstrator

   After accepting a question, the demonstrator must respond with an answer before returning to the initial state.

3. Student1 = Ø + ((q(X).a(X) + show).Student1)
   Student2 = Ø + ((q(X).a(X) + show).Student2)

   Student 1 and 2 can either give up (Ø) or ask a question (and continue after the answer) watch the video (and continue).

4. Class = Demonstrator | Student1 | Student2 | Video

   The class contains a video and a demonstrator and two students.
The process calculus models only the "externally visible" interactions. It does not model the internal decision process of any of the agents. For example: we have no knowledge of when, or why a student may choose to watch a video, rather than ask a question. This is an important issue in practice. However, in deciding whether two tools offer a similar pattern of interaction, it is not really significant. The LCC (Lightweight Communication Calculus) is an executable language based on CSS which allows us to specify the internal processes, as well as the interactions. As mentioned before, this is not so useful for equivalence checking, but it could be used to create simulations.

3 Methodology

3.1 Extra factors

The first thing that had to be done was studying the simple classification model and the CCS language (described in section 2.1 and 2.3 respectively) in order to be able to classify and draw the interaction occurs in each tool that the interviewees used for teaching. Then, the interview transcripts were studied question by question. The most important information that was attempted to extract from the interview transcripts was the extra factors that the simple classification model described in section 2.1 is not taking into account. There were many factors mentioned by the interviewees. A list of the most common factors among all the interviews is shown below (in the form of questions):

1. **Time of an interaction:**
   How long does the interaction takes? If one email interaction takes a day to complete and another email exchange takes a week to complete, are these two interactions the same? Is the tool being used in a 6 month course or a 1-year course? How important is the time of an interaction? This factor is so hard to model. The reason for that is time being a continuous value and there is not a fixed value of time for each tool.

2. **Message content:**
   What is the message conveying from one person to another in an interaction? It could be a question, an answer, or just general information. Is the interaction: "student A asks a question from student B" can be classified the same as "student A answers a question to student B"?

3. **Synchronous or asynchronous:**
   Is the interaction happening simultaneously or does each person involved in the interaction is able to take its time to respond. Some tools such as discussion board is designed for an asynchronous interaction and some tools such as Skype is mostly used for synchronous type of interaction. If three students are chatting in Skype, would this interaction be the same if the same three students were using a discussion board?

4. **Distance or on-campus learning:**
   Some type of interactions such as lecturers and tutorials requires for people involved in the interaction to be present in the same place. Other tools such as Facebook and Second-Life are designed for distanced sort of interaction. Is the interaction: "Student A is talking to student B on Skype" the same as "Student A is talking to student B in a tutorial room"?

5. **Voice, Text or Face-to-Face:**
   Based on the assumption that distance-learning is an important factor, how important is the way of communication in a distanced type of interaction? There are several tools which
support voice communication, text communication and Face-to-Face communication such as Skype and there are tools which supports only one of them such as discussion boards. Clearly there is a difference if two people involve in an interaction is using voice or text to communicate, but how important is this? Can these interaction be classified as the same?

6. **Number of people in an interaction limit:**
   Is the number of people communication with each other important? If yes, how important it is? If 5 students are communication using Skype, would this interaction be the same if 10 students were communication with the same tool?

7. **Assessment by the interaction:**
   Are the people involved in an interaction using a specific tool are interacting just simply to learn the course material or do they have to use that tool because they will be marked for their work on that tool? For example, students might be using Google-Doc to share information about a subject or they must use Google-Doc because they to prepare a presentation or a report in Google-Doc on that subject. Is assessment important enough to discriminate these kinds of interactions?

8. **Anonymous or named:**
   Are the people involved in the interaction know who are they communicating to? In both Google-Doc and wiki, people are able to comment on different part of the presentation preparing by their group. However, Google-Doc makes the tag anonymous but wiki on the other hand let the other people see the name of the writer of the comment. How much this factor influence an interaction between a group of people?

9. **Persistency:**
   Do the message contents remain visible indefinitely? Some tools such as discussion board, Snapchat and Email allow the message content to be remained for the people involved in the interaction to be able to revisit the message contents, while tools such as Skype do not allow the conversation to be recorded. How much message presidency can affect an interaction?

It would be a bad idea to apply all these factors into the model. Applying each of the factor above into modelling will result in two interaction that were equivalence before to be no longer equivalence. In other words, by modelling each of these extra factor, the size of the possible different models will be increased. What we are interested in is a modelling which the size of possible existing interactions is appropriate. If the size of the possible models is too big, then almost no interactions would be classified the same and if the size of the possible models is too small, then all interactions would be classified as the same. Thus, by attempting to model each of these factors, we pay a price. The most important factors that were considered for modelling in this project can be observed from the table below:
<table>
<thead>
<tr>
<th>Factor</th>
<th>Applied to the model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time of an interaction</td>
<td>No</td>
</tr>
<tr>
<td>Message content</td>
<td>Yes</td>
</tr>
<tr>
<td>Synchronous or Asynchronous</td>
<td>Possibly</td>
</tr>
<tr>
<td>Mark/Credit for the course</td>
<td>No</td>
</tr>
<tr>
<td>Distance or on-campus learning</td>
<td>No</td>
</tr>
<tr>
<td>Voice, Text or Face-to-Face</td>
<td>No</td>
</tr>
<tr>
<td>Number of people in an interaction</td>
<td>No</td>
</tr>
<tr>
<td>Assessment by the interaction</td>
<td>Yes</td>
</tr>
<tr>
<td>Anonymous or identified</td>
<td>Yes</td>
</tr>
<tr>
<td>Persistency</td>
<td>No</td>
</tr>
</tbody>
</table>

### 3.2 Arc labelling

The are two main reasons for choosing the factors "message content", "assessment", and "anonymous or identified". One is their importance in classifying an interaction and the other one is the small increase they cause in the size of possible different models. The question that needs to be asked here is how to apply these factors to the model described in section 2.1. The method used in this project for applying these factors into the model is arc labelling. As it can be observed in section 2.1, the arcs in figure (2) do no provide any information about the message content, or weather the interaction is being assessed by someone involved in the interaction or weather the people in the interaction know who are they interacting with. By labelling arcs in figure (2), we are able to know the answers to these questions. Two examples of this are illustrated below:

There are many different ways for labelling arcs. I have categorized the arc labels into four category, as shown in the table below. Three of these labels can be sub-categorized to two different category themselves. The hierarchy diagrams in figure (3) have illustrated these sub-categories. The question here is which of these labels in each hierarchy diagrams is suitable for modelling? By choosing the labels that are higher up in the hierarchy diagrams, we pay the same price as
the price described in section 3.1, a huge increase in the number of possible different models. If enough time was provided, different combination of these labels could be chosen for modelling following by evaluating the model and recording the size of sub-fractioned models. I have chosen the root nodes for all 4 arc labels. This has the great advantage of simplicity in modelling.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Information: Any knowledge or material from the course</td>
</tr>
<tr>
<td>Q</td>
<td>Question: Asked to know the answer or to assess the other person</td>
</tr>
<tr>
<td>A</td>
<td>Answer: Answer to a question to pass information or to be assessed by it</td>
</tr>
<tr>
<td>M</td>
<td>Meta: Identity information and everything other possible content</td>
</tr>
</tbody>
</table>

Figure 3: Arc labels. In order to have a more detailed model, arc labels in higher levels must be chosen instead of the roots

I have chosen two interaction examples for modelling using the new arc labels described above. The reason for choosing these two examples was their commonness among different departments based on the interview transcripts. The next step I took was expressing these models in CCS, in order to be able reason about them. Both examples can be observed below:

1. Example 1: Two students and a tutor are in a tutorial room. There are usually more than two students in a tutorial. The reason for choosing only two students was to avoid the diagram look messy. In a tutorial, every body knows each other and no assessments is being done.
The tutor presents his identity (not by introducing himself necessary) and then gives information and goes back to being a tutor. He also has the option to listen to a student and then go back to being a tutor. The same goes for students when they are discussing the course material in the tutorial.

2. Example 2: This model represents two students working on a project on wiki. The students exchange information in their group, and the marker is able to see their progress. But they do not know the identity of the marker.

\[ T = ((M \cdot T) + (M \cdot I)) \cdot T \]
\[ S_1 = ((M \cdot T) + (M \cdot I)) \cdot S_1 \]
\[ S_2 = ((M \cdot T) + (M \cdot I)) \cdot S_2 \]

The tutor receives the names of the students doing the project and the material of the project that they are doing (both of these cases count as meta) and then going back to being a tutor. Students give their identity and the material they wrote for the project first, then they have a choice of going back to being a student or presenting information to other students, or they can listen to another student.

There are several issues to be solved. In the tutorial example, sometimes is is information that is being exchanged and sometimes it is questions and answers. As a result, we either have to ignore one of the situations or to add more arcs. Another issue is that the CCS expressions are taking the destination of the arcs into account. In the tutorial CCS examples, it is not clear who is the person that a student is giving information to. The order of interaction is also not clear in these models. In a lot of situations, this is not important. For example, which student watches the online recorded lecture first or which student asks a question in a tutorial first \( S_1 \) or \( S_2 \). However, there might some situation where this factor matters.
The last step that I performed in this project was analysing the reasons for choosing a particular tool based on the interview transcripts. I have listed the most common sensible pedagogical aims that the University staff members have described in the interviews and I have placed them next to each other. Then, I picked the most common sensible ones to be a set of pedagogical aims (Further explanation in section 4.1).

4 Discussion

4.1 Pedagogical aims

When people are looking for a tool and trying to find a mode of using that tool, they have usually have a pedagogical aim. but how can they choose a tool, and find a mode of using it, which will satisfy their pedagogical aims? Answering this question is not an easy task and the main reason for that is defining a pedagogical aim is a hard task itself. Thus, It can be difficult to identify an appropriate tool (or a mode of using such a tool) to meet specific pedagogic aims. Sometimes the natural use of a particular tool is a good fit, and sometimes it needs creative abuse to make it fit (Anderson, Paterson, Social Media slides, page 3, 2010). If we treat pedagogical aim as a variable, one possible solution is to limit the values that can be assigned to this variable to a specified set. But how do we get a specified set? One of the question that was asked in the interviews was about the reason for using a specific tool and what they were hoping for students to get out from it. I have listed all the pedagogical purposes that the interviewees mentioned (discarding the assigned tool) and I have placed them next to each other. After observing the pedagogical aim list, I discovered that a lot of the departments have some common pedagogical aims. The list of most common sensible of these aims can be observed below:

1. **Group work:**
   One of the most common reasons for using a tool is to promote collaborative work, especially for distance students. The goal is to promote students to work together so they have the kind of support from one another as well and in order for them to not to feel isolated while working on individual assessment on their own computer with no one around to help. It has been studied that students are able to learn from each other more (Roger, David, 1988). They see how other people write things, and they get feedback, they get used to giving feedback and have the whole experience of the dynamics of a group environment.

2. **Research:**
   Most of the courses in postgraduate involves research work. Thus, some programs are designed to help the students about the process of doing a research. This is less about substantive stuff because activities such as reading can be done individually. It tends to be more practical exercises and it is less about discussing a particular theory. The idea is more about them bringing in a piece of work and comparing that piece of work to the work of different groups and realizing that what information is missing and what extra things has been added by each group. As a result, it is about comparing data, and the practical side of things. Wiki and Google-Doc are popular tools for this case.

3. **Covering course materials:**
   Almost all courses have at least one particular tool that is being used among students to discuss the materials in the book or the lecture of that course. Experience has shown that even if the course organizer does not recommend a tool for this case, students will find a tools that suits for them and use it to cover the course material regardless. Tools such as face book, Twitter are the tools that students use on their own for covering the course material. Several departments are using discussion boards.
4. Improving generic skills:

Sometimes a tool or a program is used to simply improve the generic skills of the students such as gaining the confidence to speak up. In many situations, it can be observed that students are talking in a lively way in their groups but when they are being asked to tell the class what they have been discussing, they just clam up. Therefore, some professors and lecturers try to get them to apply their understanding. Programs such as Presentations and small tutorial group discussions are suitable programs for this case.

4.2 Effectiveness of a tool

There were many tools that were being used by the University staff members such as Blogs, VLEs, Google-Hangout, Skype and Twitter. The question is what makes a tool better than another? What are the factors that enables us to compare the effectiveness of different tools in different situations? One of the questions that have been asked in the interviews was regarding this subject. They have been asked to describe what they found useful about each tool that they are using and what do they consider as a weakness of those tools. In order to answer the question asked earlier, a list of factors are needed. A summary of these factors based on the interview transcripts is shown below:

1. The course:
   There is a huge difference between the material of different courses. A tool that is being used for a geography course might not work as well for a math course. Thus, the course which the tool is being used for is important. Unfortunately, we are unable to treat different subjects differently when modelling. This is because there are so many subjects and by treating each of them as a separate subject, the number of possible models will become extremely large. As a result, no two interactions will be classified as the same. However, it might be possible to divide courses to categories. For example, Mathematics, Physics and mechanical engineering can fall into one category and all languages courses fall into another category.

2. Level of the course:
   There are 2 different levels for each subject: undergraduate courses and Postgraduate courses. The reason for the importance of this factor is that a tool that is used for teaching first year undergraduate students might not work well for postgraduate students or an honours course. This factor can be treated as a pedagogical factor. Most postgraduate courses desires improving research skills, but for first year undergraduate students it is the exam taking and revision skills that are more important.

3. Popularity of the tool:
   One important factor that is able to make a tool more effective than others in practise is the popularity of the tool. For example, Skype is an application that is known to be available to almost all students. This factor makes Skype more effective than many other telecommunications application software that provide video chat.

4. Graphic card:
   Some telecommunication application such as Second-Life require a stronger graphic card than other applications. As a result, these applications do not work well on everyone’s computer. However, since most universities provide reasonably strong computers for their students and the majority of the students have access to good hardware, this factor does not have a major impact on effectiveness of a tool.

5. Number of people allowed in the interaction:
   The last factor that can make an application more suitable than others is the number
of people allowed in the communication. This factor is important especially in distance learning. In an application such as Skype, the maximum number of people engaged in group video calling is 10. As a result, if there is a tutorial of 11 people in a distance learning course, Skype is not an option.

I have also compared similar tools based on the judgements that have been extracted from the interview transcripts. By similar, I mean the tools that the University staff members use them for similar purposes.

1. Skype and Second-Life:
The main use of both Skype and Second-Life is virtual classrooms in distance learning courses. They both allow communication in both text and voice. Second-Life allows you to record the virtual classroom and post it on Youtube. It is known to create a good feeling and the visual element makes people feel connected. The main disadvantages of Second-Life compare to Skype is the slowness of its text-chat and the better graphic card it needs.

Skype also allows you to have synchronous seminars and tutorials just as Second-Life dies. It also allows you to communicate using video. However, a few interviewees found the video distracting. It is a more common tool than Second-Life and it is easy to download.

The main disadvantages of Skype compare to Second-Life is the the limit it has for number of people in videos and the inability to record the video conversations or calls.

2. Wiki and Google-Doc:
Wiki and Google-Doc are both famous for their ability to co-author and they both are widely used for creating group presentation and posters. Wiki has one particular great property: it keeps all previous versions of the page that the group is writing on. This property allow the students to edit each other’s work with more confidence. Google-Doc allows you to comment as if you are using comment in a word doc. It relates the comment to the specific text. Whereas in wiki, if a student leaves a comment it comes up at the bottom of the page and it is not so clear what the comment relates to. Google-Doc tags whatever comments you make as anonymous so it is not clear who is commenting. Thus, this can be concluded that a tool that combine the suitable elements of wiki and suitable elements of Google-Doc would be a great and useful application to build.

3. Facebook and Twitter:
Most students use Facebook and Twitter as their own individual application rather than tools to learn from tutors or lectures. Both of these tools are mostly used as a fun application. This factor makes them suitable tools for creating a good feeling and a comfortable environment between students. However, a few lectures have mentioned that students share all the answer to all hand-in questions which are supposed to be done individually. Another problem with these tools are the many offensive comments that are used in them frequently. This is due to the fact that many students do not take these tools seriously. As a result, both of these tools are know to be pedagogically worthless.

4.3 Further work
Further work can done in designing and applying arc labels to the models. For example, after choosing one set of arc labels, a real world example from the interview transcripts can be chosen to observe how well the arc labels fitted that particular situation. Another good way of continuing this project would be to interview several member of University staff who are involved in teaching, and provide them with several different example pair of models and ask them about the equivalency of these models. The information achieved from this experiment would help a lot to find out how well-fitted the models are. However, this experiment requires signification
amount of time.

If more time was available, the process of matching models would be studied and analysed. That is, given some model of the requirements, find a set of models that is possible compose together that would include (possibly a superset) of the requirements. The matching process would allow us to test how well-fitted the labelled arcs (or possibly arc labels which were higher in the hierarchy diagrams) are in my model. Also, writing a code to automate this matching process would make a great contribution to this project.

5 References

[1] Paul Anderson, Kirsty Hughes, Hamish Macleod, Jessie Paterson, Orchestrating the Student Experience with Social Media Tools slides, 2010


