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INDICATORS FOR MEASURING QUALITY IN ASYNCHRONOUS DISCUSSION FORAE

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ABSTRACT

Asynchronous discussions are widely used in Distance Learning approaches. DIAS is an Asynchronous Discussion Forum Software, mainly developed in order to offer extended monitoring and interaction analysis support, by providing a wide range of indicators jointly used in various situations, to all discussion forae users (individual user/students, groups, moderators/teachers or even researchers/observers), appropriate for their various roles in different activities. In this paper we describe two of the integrated Interaction Analysis (IA) Indicators, concerning the Quality assessment of a discussion.

KEYWORDS

Asynchronous Discussion, Interaction Analysis, Forum, Quality, Thread Propagation

1. INTRODUCTION

Computer Mediated Communication (CMC) tools, allowing communication among users by means of networked computers, for the purpose of discussing topics of mutual interest, are actually used in educational, working, or every day life contexts. In particular asynchronous discussion forae are nowadays widely used in formal or informal educational contexts, applying principles of constructivism, emphasizing in social interaction during learning activities (Corich et al, 2004).

An overview of the literature reveals a number of studies addressing the problem of assessing and supporting discussion activities (Stahl, 2006). Our approach tries to meet both these goals by applying Interaction Analysis techniques, taking into account quantitative data. We have developed a discussion forum platform with integrated Computer Based Interaction Analysis tools called D.I.A.S. (Discussion Interaction Analysis System). We are aiming at supporting all users (moderators, learners, researchers, etc) and facilitating discussion learning activities (Bratitsis & Dimitracopoulou, 2005; 2006). Two of the many IA indicators produced by DIAS system are presented in the current paper. They intend to provide an easy and quick method of distinguishing the more qualitative threads of a discussion forum, without having to read the messages and thus facilitating the moderating labor of a teacher within dialogic learning activities.

2. ASSESSING THE QUALITY OF A DISCUSSION

2.1 Related Work

Since Mason described her model of qualitative analysis of a discussion and the five dimensions introduced by Henri (1992) up to the approach of Gunawardena et al (1997) and the *Community of Inquiry* model developed by Garisson et al (2001), the importance of the interactions of a person within a community is underlined, in order to achieve critical, high order thinking along with internal reflection. As pointed out by Dillenbourg (1999) it is necessary for the learner to externalize his/her thoughts and ideas in order to achieve proper reflection. Literature points out that intensive discussion and social interaction may lead to multiple knowledge construction phases (Schellens & Valcke, 2005). According to Weinberger & Fischer (2006), knowledge construction through argumentation is based on the assumption that learners are involved in dialogic activities and the frequency of participation is proportional to knowledge construction.

Henri (1992) in her model indicates user participation as one of the key dimensions, which in Garisson et al's (2001) model is addressed to under the term of social presence. Weinberger & Fischer (2006) believe that argumentation activities facilitate knowledge construction, taking into account several issues, such as learners' participation and the uniformity of their participation. Besides, the importance of a critical mass of users in order to sustain a learning community has been highlighted (Pallof & Pratt, 1999).

After examining the aforementioned approaches it is safe to conclude that the amount of users participating in a dialogic activity is proportional to the quality of the activity itself. Therefore we may consider the number of users posting messages in a discussion thread as an indication of the thread's quality (more users lead to higher possibilities of a qualitative dialog).

Other dimensions have been used for measuring the extent of collaboration (therefore the quality) in a discussion, such as the amount of messages constituting a thread (Harasim, 1993). This number alone is not a safe indication, taking into account that a large amount of messages may be produced by only a few users (even a dyad), thus not contributing to group argumentative knowledge construction. Furthermore, large amount of messages does not always imply high argumentative quality in a discussion. Many messages may be of a social context or a part of an extended disagreement of a small number of users and thus contain small amount of words or even less interest for the rest of the participants. Consequently, the number of messages is an indication of activity, necessary for learning and knowledge building, but does not reflect the level of learning (Mason, 1992).

Thread depth is used for distinguishing important threads. It is calculated as the larger amount of subsequent messages forming a path within a thread. According to Hewitt (2003), "extended online dialogue should ideally be the norm. Limited thread growth appears to be a persistent and widespread problem". Thus, the sustention of a thread's growth is a target of a discussion's moderator, in order to facilitate collaboration and knowledge building among the learners. Consequently, thread depth is an indication of intense and hopefully fruitful collaboration.

Simoff (1999) seems to agree, while proposing a visualization method for evaluating collaboration intensity and extension in a discussion forum. He introduced a thread representation with a set of nested rectangles, depicting the depth and the levels of a thread, along with their width (number of messages per level), while attempting to identify collaboration patterns within the various threads of a discussion forum. He states that "The collaboration is closer when there are large thread widths and lengths" (Simoff & Maher, 2000).

Finally the mean number of words has been suggested by Benbunan-Fich & Hiltz (1999) for measuring collaboration extend. They suggest that well connected, technology supported groups produce longer products, in matter of words, than individuals or loosely connected groups. By validating their hypotheses, they indicated that longer products correspond in higher discussion quality.

2.2 The DIAS system approach

2.2.1 Thread Propagation (T_P) and Thread Propagation Word (T_{PW}) Indicators

In the aforementioned approaches we distinguish five quantitative dimensions, used as indicators of quality in a discussion forum thread: a) Number of users, b) Number of messages, c) Thread depth, d) Thread width, and e) Mean number of words. In our approach we try to combine all five, while producing a numerical value, indicating the more qualitative threads in a discussion. We have extended Simoff's definition of message width, to introduce the concept *Thread Width*, defined as the largest amount of messages in one level, within a discussion thread. We have constructed two different indicators: a) Thread Propagation Indicator (T_P), and b) Thread Propagation Word Indicator (T_{PW}). The mathematical algorithm used is:

$$T_P = \frac{\left(\left((150 * T_D) - \sum_{i=1}^{T_D} \frac{100}{MPS_i}\right) * T_{WD} * T_D\right)}{1000} \qquad T_{PW} = T_P * \frac{W}{P*100}$$

where:

- T_D is the depth of the thread
- T_{WD} is the width of the thread
- MPS_i is the number of siblings of the parent of message i
- W is the number of words in all the messages of the thread
- P is the number of posts in the thread

While calculating the T_P indicator, we assign a value of 150 for each level of the thread. From the product we subtract a weighted value, which takes into account the number of messages included in every branch of the thread. For the thread in Figure 1, for message A, is in the 7th level. It is the only child of message B, so the weight of their connection is 100. Message D has 3 children, so the weights of the connections with them are 33 (100/3). By applying our algorithm for message A, we get:

$$T_P = \frac{\left(\left((150*7) - (100+50+33+100+20+33)\right)*6*7\right)}{1000} = 29.99$$

This algorithm produces a lower value for every other message of this thread. Consequently, the thread propagation value is 29.99. The width of this thread equals to 7, as there are 7 messages in the 3rd level.

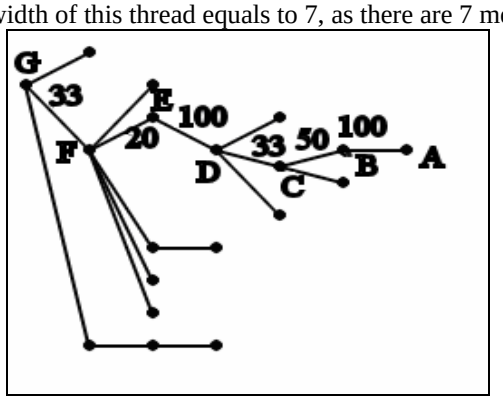

Figure 1. Example of calculating Thread Propagation Indicator

The T_P indicator provides a measurement of the propagation of a discussion thread. During the calculation of the indicator's value, the total width, the depth and the distributed width of the thread are taken into account. Higher values indicate more complex threads, thus distinguishing the most interesting (contributing more to the discussion quality) threads for someone to revise. We make the assumption that wider, longer and more complex evolvement of a discussion thread are the more interesting to revise, as they imply increased interaction among the participants.

On the other hand, the T_{PW} indicator provides a connection of the T_P indicator's value with the number of words constituting the messages of each thread.

2.2.2 Visualization of the Indicators

In Figure 2a we can see some discussion threads. For the presentation of the Thread Propagation Indicator, we produce a double bar chart, which contains all the threads of a discussion forum (Figure 2b). The right hand chart shows the T_P value, while the left hand chart shows the values of: a) number of messages, b) thread width, c) number of users, and d) thread depth. For the representation of the Thread Propagation Word Indicator, we use a similar visualization, where the mean number of words is added in the left hand chart and the T_{PW} is added in the right hand chart. For threads containing 1 or 2 messages, we omit the T_{PW} bar from the chart, since it usually has a very high and erroneous value.

This visualization method allows the revelation of all the aforementioned dimensions of the discussion threads through a quick inspection, allowing to consider the T_P and T_{PW} indicators as transparent ones.

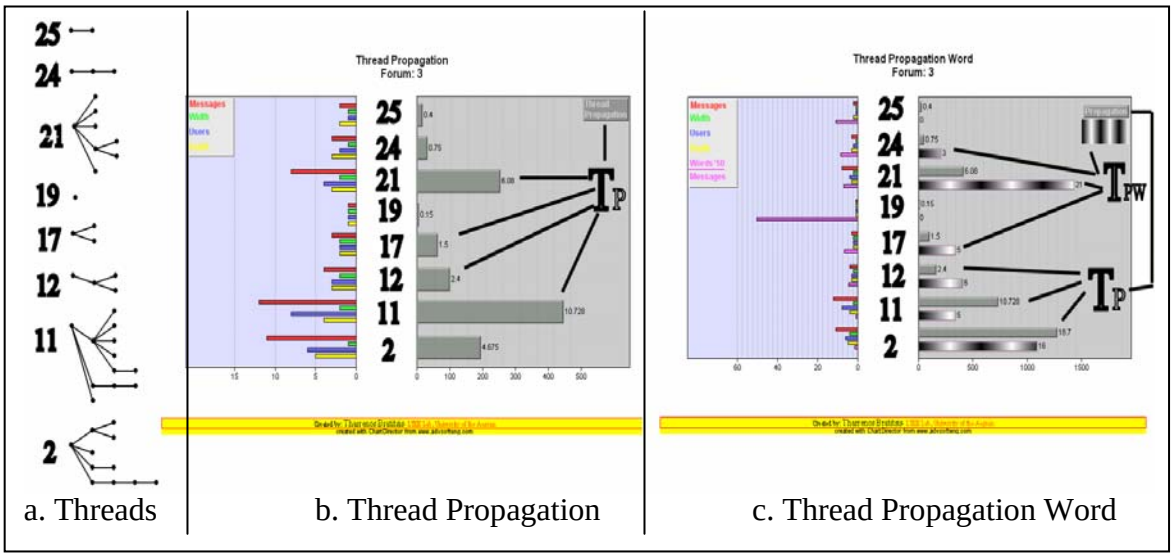

Figure 2. Visualization of Indicators T_P and T_{PW}

2.2.3 Testing the Indicators

The thread depth dimension is dominant in the proposed algorithm. Let's examine threads No 24, 12 and 17 in Figure 2. Thread No 24 seems to be a discussion between two users, implying a Question-Answer-Answerback pattern. On the other hand, thread 17 seems to follow a Question-Answers pattern, involving 3 users. Both threads are of similar interest regarding the forum evolvement. For thread 12 the T_P score increases significantly, due to the branching in the end. This indicates a preliminary dialogue, which seems much more important than the previous two threads.

Combining these results with the T_{PW} Indicator, new perspectives arise. In threads No 24 and 17 the messages are quite larger, indicating a possible exchange of arguments or ideas, as opposed to thread 12. This indicates a coordination message exchange for thread 12 (which is the actual case), where in threads 17 and 24 disagreements where expressed.

This simple example shows that three threads with similar constituents' values may vary significantly, due to the content and the purpose of their messages. In a case of large forum, a significant amount of time is required to separate the threads which are important for the evolvement of the discussion. Indicators like the ones presented in this paper could facilitate and automate such a procedure. They are addressed to the moderator of the discussion.

3. CONCLUSION – FURTHER WORK

As stated in the beginning of this paper, several quantitative dimensions have been proposed in order to indicate and evaluate the quality aspect of a discussion activity, without having to refer to content analysis methods. When examined independently, erroneous conclusions may be drawn. For example deeper threads (large thread depths) do not necessarily indicate quality dialog, as they could contain a disagreement of two single users for a less important for the learning activity matter. Likewise, large thread width could be the case of a coordinating communication, which is not to be included while qualitatively assessing a discussion, in matters of argument building. Of course such threads are important for the total assessment of the learning activity, as they indicate aspects of the participants' collaboration method.

Our approach tries to combine all these aspects by providing visualized indicators, easy to review. They are addressed to the discussion moderator, wishing to distinguish the important threads of a forum, for further examination, helping him/her to diminish the workload of traditional methods (e.g. read all messages). The construction of the proposed indicators arose from requests of moderators using the DIAS system, expressing their needs for assessing discussion threads. These indicators are more useful in large forae, containing many threads, produced by many users. They can be used with equal efficiency in medium sized or even smaller forae, in matters of user and message numbers. Nevertheless, in the cases of smaller forae the usability of these indicators is low, since it is relatively easy to revise the thread content.

Our future objective is the construction of a model reference table of scores, corresponding values of the indicators to specific patterns of interaction. Besides their use as quality indicative values, distinguishing the most important threads has been stated, as described in the related work section of the current paper.

Finally, a connection of the relation between the two indictors' values and the actual content of each thread is being investigated, under specific teaching settings within an asynchronous discussion. For that matter, several case studies have been designed and implemented. Currently the results are analyzed. Our purpose is to examine the relation of a thread's argumentation quality with the indicators' values, which seems to occur under several argumentative learning activities.

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