

# Learning Analytics To Identify Exploratory Dialogue within Synchronous Text Chat

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**Abstract.** While generic web analytics tend to focus on easily harvested quantitative data, Learning Analytics will often seek qualitative understanding of the context and meaning of this information. This is critical in the case of dialogue, which may be employed to share knowledge and jointly construct understandings, but which also involves many superficial exchanges. Previous studies have validated a particular pattern of ‘exploratory dialogue’ in learning environments to signify sharing, challenge, evaluation and careful consideration by participants. This study investigates the use of sociocultural discourse analysis to analyse synchronous text chat during an online conference. Key words and phrases indicative of exploratory dialogue were identified in these exchanges, and peaks of exploratory dialogue were associated with periods set aside for discussion and keynote speakers. Fewer individuals posted at these times, but meaningful discussion outweighed trivial exchanges. If further analysis confirms the validity of these markers as learning analytics, they could be used by recommendation engines to support learners and teachers in locating dialogue exchanges where deeper learning appears to be taking place.

**Keywords.** educational dialogue, text chat, instant messaging, exploratory dialogue, learning analytics, synchronous dialogue

## Introduction

Learning resources are being uploaded to the Internet at such a rate that is increasingly likely that individuals will find themselves adrift in an ‘ocean of information’ [1, p136]. Resources that extend over time, such as conference recordings, videos and real-time dialogue capture are difficult to scan or assess quickly and so learners and teachers must rely on basic, often misleading, cues such as title, keyword and producer when deciding whether to make use of a resource. Analytics are therefore needed to distinguish between resources that extend over time, and to identify those that support learning. This paper investigates the use of key words and phrases to identify sections of Elluminate® online conference sessions that have inspired participants to engage in knowledge building through dialogue in the associated synchronous text chat.

In other contexts, various approaches have been used to identify and classify forms of learning dialogue and academic dialogue but these are typically dependent on the use of grammatically correct, carefully punctuated and formally structured text [2,3]. Synchronous textual dialogue is likely to be more akin to speech than to formally constructed prose [4]. It is therefore relevant to look at how people build knowledge together through speech. In face-to-face settings, Mercer and his colleagues [5-9] have distinguished three social modes of thinking used by groups of learners: disputational, cumulative and exploratory. Of the three, exploratory dialogue is the type considered most educationally desirable by teachers [10]. Mercer and Littleton [8, 62] provide a clear description of its use in a school environment:

Exploratory talk represents a joint, coordinated form of co-reasoning in language, with speakers sharing knowledge, challenging ideas, evaluating evidence and considering options in a reasoned and equitable way. The children present their ideas as clearly and as explicitly as necessary for them to become shared and jointly analysed and evaluated. Possible explanations are compared and joint decisions reached. By incorporating both constructive conflict and the open sharing of ideas, exploratory talk constitutes the more visible pursuit of rational consensus through conversation.

Exploratory dialogue is a form of discourse that may be found in both online and offline learning environments [4,11], where it can be taken as an indication that learning is taking place and that learners are going beyond a simple accumulation of ideas. The research reported here therefore asks: *Could the identification of exploratory dialogue within the synchronous textual chat associated with online resources help to identify resources and sections of resources that support learning?*

### **Data collection and preparation**

In order to investigate these questions, data were collected from Elluminate, a web conferencing tool that supports chat alongside video, slides and presentations. The focus was on the synchronous discussion related to a two-day online teaching and learning conference. The Elluminate text chat in four conference sessions, each between 150 and 180 minutes in length (24,530 words in total) was investigated. During these four sessions, 233 participants logged in to the Elluminate sessions at one or more times. The majority of these participants were higher education researchers and practitioners from around the world, although most were based in the UK. Analysis presented in this paper focuses mainly on the afternoon session of 22 June, when 120 people logged in to the Elluminate discussion and 67 actively participated in the Elluminate synchronous text chat. Of these participants, 47 were female (26 contributed to the text chat), 54 were male (34 contributed to the text chat) and the gender of 19 is unknown (7 contributed to text chat). The conference timetable was used to subdivide the four main conference sessions into smaller units, including pre-session chat, post-session chat, conference introduction, groups of short talks, longer talks, moderated discussion and keynotes.

The four conference sessions were all archived and made public by the organizers. Sociocultural discourse analysis [12] was used to identify words that could be indicative of exploratory dialogue. These included:

- **Challenges** eg But if, have to respond, my view
- **Critiques** eg However, I'm not sure, maybe
- **Discussion of resources** eg Have you read, more links
- **Evaluations** eg Good example, good point
- **Explanations** eg Means that, our goals
- **Explicit reasoning** eg Next step, relates to, that's why
- **Justifications** eg I mean, we learned, we observed
- **Others' perspectives** eg Agree, here is another, take your point

Ninety-four words and phrases were identified in this way. Some words, phrases and punctuation, which initially appeared to be good indicators, were discarded because they were often used for finding out more about the conference, its tools and participants, rather than its content. For example, interrogatives and question marks were often associated with comments such as 'Can you still hear?' or 'what's everyone doing for coffee???' Once exploratory markers had been identified, the Elluminate chat was pasted into Microsoft Word, where a simple 'find and replace' Apple Script program was used to highlight the key words and phrases. The data was then transferred to Excel for more detailed analysis. Table 1 gives an example of a section of data in which six of nine consecutive postings were coded as exploratory. By way of contrast, Table 2 gives an example of nine consecutive postings in the data, none of which was coded as exploratory.

Table 1: Dialogue coded as exploratory (real names removed from all data samples). Each row of the table represents one contribution. Words in bold have been highlighted by the analysis.

<b>what about</b> quality control? Not all authors are as skilled as [named individual]...
Ie could get some dreadful blunders in public!
If you're doing it in public and people are following, that wil help in terms of quality control for egregious errors. <b>However</b> , if you're writing it in a vacuum, then that's not going to work so well, I guess.
<b>Also</b> , not everyone's blog has the traffic [named individual]'s has
Is it only skills that are needed, is it? There's something to do with attitude (to criticism, to mistakes, etc) – [named individual]? (sorry, no mic)
Shouldn't, in theory, course authors be writing carefully in the first place, <b>because</b> it's going to be seen by hundreds or thousands of students?
I would just note that a course team of 6 or 7 people can feel plenty public enough when you are trying to form thoughts - this is back to <b>my point</b> about there being stages where its good to be quite closed while you evolve an idea and approach
@[other conference participant] - yes, I think that educators will get a lot more out of this scary paradigm shift if they have set up some peers who also want to learn
[Another conference participant] <b>Definitely</b> or even interested "amateurs".

Table 2: Dialogue not coded as exploratory. Each row of the table represents one contribution.

like the idea of a virtual poster session
shame - sadly I can't make Friday
All my intelligence is artificial
>embarrassed<
@[named participant] – it'll be asynchronous so drop in any time
Audio dropped out
Uhoh
Sound cut out
We've lost you [named participant]

Once key words had been highlighted, the postings were divided according to the timings on the official conference timetable, and the use of exploratory dialogue in each section was calculated. As postings are short and clearly delineated, the posting was taken as the unit of analysis, and so an entire posting containing one or more markers of exploratory dialogue would be coded as exploratory.

The conference included two morning sessions and two afternoon sessions. The first phase of analysis focused on identifying the periods containing the greatest concentration of exploratory markers. The four main sessions were first rated on the amount of turns in the conversation rated as exploratory (those containing one or more of the words/phrases indicating exploratory talk). The total number of exploratory turns was divided by the number of people contributing to the posting dialogue, to give an average number of exploratory posts per person.

$$\frac{\text{Total exploratory turns in dialogue}}{\text{Number of people contributing to posted dialogue}} = \text{average no of exploratory posts per person}$$

In addition, the number of words in the turns considered exploratory were totaled and divided by the number of people contributing to the posted dialogue, to give an average number of exploratory words per person. The results are shown in Table 3.

$$\frac{\text{Total words in exploratory turns}}{\text{Number of people contributing to posted dialogue}} = \text{average no of exploratory words per person}$$

Table 3: Comparing exploratory turns per person in main conference sessions

	22 June am	22 June pm	23 June am	23 June pm
Average no of exploratory turns <b>per person</b>	1.6	3.5	2.3	1.9
Average no of exploratory words <b>per person</b>	32.7	59.1	41.4	39.3

In both cases the afternoon session of 22 June pm, which contained one of the two keynote sessions, appears to have inspired the most exploratory dialogue. On the other hand, the morning session that day appears to have inspired the least learning

dialogue. As the four conference sessions differed in length, it is possible that these differences were related to having more or less time in which to post.

Table 4 therefore indicates the average number of exploratory turns posted per minute, and the average number of words in exploratory turns posted per minute.

Table 4: Comparing exploratory turns per person in main conference sessions

	22 June am	22 June pm	23 June am	23 June pm
Average no of exploratory turns <b>per minute</b>	0.7	1.1	0.7	0.5
Average no of exploratory words <b>per minute</b>	14.8	19.2	12.8	11.1

Once again, the afternoon of 22 June contained the most exploratory dialogue. However, the least exploratory dialogue now appears to have taken place on the afternoon of 23 June. Further analysis is required in order to investigate which of these measures is most relevant.

As all measures indicate that the afternoon of 22 June contained the highest concentration of exploratory markers, the following analysis concentrates on that session. During that afternoon, the Elluminate session was divided into four sections: a set of short talks, moderated discussion, keynote, and then chat between the scheduled end and the actual close of the Elluminate session.

Table 5: Comparing contributions to the synchronous Elluminate text chat during one continuous afternoon conference session (22 June)

	<b>Short talks (60 mins)</b>	<b>Discussion (45 mins)</b>	<b>Keynote (75 mins)</b>	<b>Chat (8 mins)</b>
<i>Posts per minute</i>				
Mean no of posts per min	2.4	4.6	5.8	8.8
Mean wordcount per min	21.3	47.8	67.5	57.6
Mean no of exploratory posts per min	0.4	1.2	1.6	0.9
Mean word count of exploratory posts per min	5.2	18.6	31.1	11.8
<i>Posts per contributor</i>				
Mean number of posts per contributor	5.4	5.6	10.1	3.3
Mean word count per contributor	47.3	58.2	117.7	22.0
Mean exploratory posts per contributor	0.9	1.5	2.8	0.3
Mean word count of exploratory posts per contributor	11.4	22.6	54.2	4.5

Table 5 presents a summary of analysis of that afternoon’s Elluminate chat. As the length of the sessions ranged from 8 to 75 minutes, contributions were first classified by time. This showed that the most posts per minute took place during the informal chat session, whereas the most exploratory posts were contributed while the keynote was in progress. The series of short talks at the beginning of the afternoon appeared to be associated with the lowest levels of talk, whether exploratory or not.

On the basis of markers of exploratory dialogue, it therefore appears that conference participants engaged in the highest levels of knowledge construction on the afternoon of 22 June, and that these levels were highest during the 75-minute keynote discussion. It is not possible to represent the whole Elluminate session here, but Table 7 provides a one-minute extract. If a recommendation engine were to use these markers to identify sections of the 12-hour conference where knowledge construction took place, it would recommend sections like those shown in Table 6.

This minute contains 6 exploratory turns (mean for the keynote was 1.6 per minute), it contains 192 words (mean for the keynote was 67.5 per minute) and it contains 81 words in the exploratory turns (mean for the keynote was 31.1 per minute). Using the markers has clearly not identified all the exploratory turns, but it has successfully identified a section including challenge (line 5), critique (line 7), discussion of resources (lines 2 and 5), evaluation (line 12), explicit reasoning (line 4) and consideration of the perspective of others (line 9, among others). The discussion moves fast, contains contributions from nine different participants, and is grounded by references to two online resources as well as to examples drawn from three separate higher education establishments. It clearly relates to the presentation that is taking place in the audio channel, which is referenced in lines 1 and 2, and it moves this discussion on by posing questions and relating the discussion to personal experience.

Table 6: One minute of Elluminate text chat, with exploratory markers highlighted in bold

1	aaagh the imaginary wife again [speaker]
2	[The speaker]’s argument is very congruent with John Seely Brown et al’s arguments on the shift from Push to Pull <a href="http://en.wikipedia.org/wiki/Pull_Platforms">http://en.wikipedia.org/wiki/Pull_Platforms</a>
3	@[online participant] the value is in what they learn
4	the <b>problem is</b> there is not one suitable analogy as the role is still very complex – it’s easier to <b>understand</b> it in regards to what we do not do anymore (e.g., supply/provide all content)
5	“Get rid of the notion of space and place...” -- not sure about that there is a well developed notion in architecture of a Place as a meaningful Space, which has since been translated to collaborative systems – PDF <a href="http://bit.ly/bM6Xr2">http://bit.ly/bM6Xr2</a>
6	Who is going to generate the knowledge then?
7	<b>what about</b> learning goals and learning outcomes? they stay?
8	<b>What about</b> the research into teaching agenda?
9	I <b>agree</b> that a common lamentation from students asked to construct their own way is “What am I paying for you”?
10	it;s <b>also</b> about inspiration take this backchannel for <b>example</b>
11	Students come to my institution to spend time with the “great minds”
12	At the OU, it is the ALs who are the biggest luddites, in <b>my experience</b> .

As Elluminate identifies who has posted each comment in the text chat, it was also possible to consider the postings of individuals (only the participants who made some contribution to the live chat were included in this analysis). Once again, a large amount of exploratory activity was evident during the keynote on 22 June, whereas the many contributions during the informal chat were found to be short and lacking in exploratory talk. When analysed in this way, participants were seen to be contributing longer, more thoughtful posts during the short talks at the beginning of the afternoon but, once again, the exploratory dialogue was less evident during these short talks than during the moderated discussion or the keynote.

Table 7 summarises analysis of the activity by individuals during the keynote talk and compares the contributions of the five people who posted the most contributions during this session. The moderator (M) was very active, posting 32 times.

For all these individuals who posted a large number of posts, more than a fifth of their words were in contributions containing exploratory markers. However, there are notable differences within these groups, and C stands out as a high-volume poster with 75% of her total words in posts containing exploratory markers.

These figures were typical of those in other sessions – the moderator was consistently one of the most active contributors. Although individuals’ interest and attention clearly fluctuated according to session, C was often among those with the highest percentage of exploratory posts in a session.

Table 7: Analysis of the contributions of the five individuals who contributed the most posts during the keynote session.

<b>Contributor</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>M</b>
Posts (Mean = 5.6)	16	16	17	27	32
Wordcount (Mean = 58)	111	183	297	210	253
Exploratory posts (Mean = 1.5)	3	3	11	6	7
Exploratory wordcount (Mean = 22.6)	43	38	224	75	105
Exploratory posts as % of personal posts	19%	19%	65%	22%	22%
Exploratory wordcount as % of personal wordcount	39%	21%	75%	36%	42%

A recommendation engine using markers of exploratory dialogue to search for people engaged in learning would therefore have highlighted C. Her contributions, such as the one below, incorporated important elements of knowledge building, including explanation, explicit reasoning and discussion of resources. In addition, many of her contributions, like this one, were addressed to a named participant in the conference, indicating that she was engaging in dialogue, rather than adding didactic comments or personal reflection.

Learning should be an active process, [named participant]. Lectures, like television, tend to be more passive. Not all lectures are like that, but most are. Recording them and putting them on the web doesn't make them any

better. That's why social knowing (John Seely Brown) is so much better, where people come together to construct knowledge through their conversations and interactions with each other. Alternatively, engaging in projects or experiments can be useful.

### **Discussion**

Preliminary analysis of the data suggests that markers of exploratory dialogue can be used to distinguish meaningfully between Elluminate sessions and to support evaluation of those sessions. The markers proved to be a more nuanced tool than generic analytics, such as simply counting the numbers signed in for an Elluminate session, or contributing to the text chat. Peaks of posting activity were associated with the end of Elluminate sessions, when many participants were thanking speakers and saying goodbye, while others were discussing what they had learned. Peaks of exploratory activity, on the other hand, were associated with periods set aside for discussion and keynote speakers. Fewer individuals posted at these times, but meaningful discussion outweighed trivial exchanges.

Exploratory markers indicate the importance of context when assessing learning dialogue. When several speakers were presenting in close succession, posting activity was relatively low, but increased as the presentations came to an end. However, when speakers had time to engage in discussion as part of their allotted timeslot – as was the case with the keynote speaker – meaningful exchanges peaked. Unscheduled chat at the beginning of Elluminate sessions tended to be primarily social in nature, while unscheduled chat was likely to include many more exploratory exchanges.

This has implications for those scheduling online conferences – clearly flagged discussion sessions related to presentations will be easier to find in the archives than discussions that overrun into other sessions. Discussion continues after scheduled sessions, so it could prove useful to leave Elluminate sessions open for chat for some time after the end of the scheduled presentation.

Not all exploratory dialogue related to conference content – there was considerable discussion of online conferences and of social issues. A future set of exploratory markers should identify keywords such as 'mike', 'sound' and 'how are you' that would signal a move away from discussion of content. At this stage, though, analysis suggests that time needs to be set aside for these exchanges, to avoid distraction or cognitive overload when presentations begin.

### **Areas for further investigation**

Data analysis covered two complete days of online conference, and only a representative sample can be presented in a paper of this length. However, the analysis to date is clearly limited in its scope and there is a pressing need for evaluation of the reliability and validity of these presumed markers of exploratory dialogue – both individually, and as a set. If this set, or an amended set, of markers can be shown to be reliable and valid it will be important to attend to both context and practicalities. Exploratory dialogue is not necessarily focused on learning about

content – individuals and groups are also likely to be learning about the tools they use (such as Elluminate) and the people with whom they are interacting. This type of learning dialogue is of less interest for people participating after the event, as they are neither using the same tools in the same way nor interacting with the same people.

From a practical perspective, the current analysis is mainly carried out manually and in future it will be necessary to investigate how this process can be carried out automatically in order to benefit both learners and educators. It will also be useful to investigate the relationship between the text chat and the audio and video channels.

Compared to other computational linguistics approaches to text analysis, the approach presented in this paper is very simple; we are testing the limits of the simple exploratory dialogue markers described. In parallel, however, we are also beginning to test more complex forms of computational rhetorical analysis as described by Sándor [13,2], as a way to detect linguistic phenomena associated with the making of knowledge-level claims around open educational resources, on which we hope to report in future work.

### **Conclusion**

Although the conference sessions studied here are freely available as open online resources, they are both difficult and time-consuming for users to navigate. The published timetable of the conference gives some guidance, but is limited because a few sessions were reorganized, started late or overran. Some provoked little debate, whereas others inspired discussion which extended far beyond the scheduled time period. The conference also included set-up sessions and breaks, during which talk turned to the practicalities of microphone use, and the absence of virtual biscuits. There is therefore a need for analytics that will allow learners to locate sections of an Elluminate session that clearly support learning.

At the same time, both learners and educators can benefit from tools that allow them to use Elluminate and other, similar, resources more effectively. Analytics can be used to distinguish different types of contribution to text chat, and to support learners who wish to engage in more fruitful learning discussion. They can be used to help educators schedule events in order to support discussion, and to model exploratory dialogue within that discussion.

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