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ABSTRACT

This paper attempts to examine different methods of content analysis for student online discussion that takes place on bulletin boards. The purpose of that analysis is to determine whether higher order thinking can be distinguished within transcripts of dialogue. The context of the analysis was a higher education undergraduate course. A group of students were presented with a discussion topic and were given a series of criteria against which their work would be assessed. At the end of the discussion their dialogue was analyzed using three different techniques which were then compared to identify whether any one method could be recommended to other practitioners. Suggestions for evaluation of bulletin board transcripts are made on the basis of this investigation. (Contains 17 references and 5 tables.) (Author)

Multiple perspectives on the evaluation of online discussion

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Abstract: This paper attempts to examine different methods of content analysis for student inline discussion that takes place on bulletin boards. The purpose of that analysis is to determine whether higher order thinking can be distinguished within transcripts of dialogue. The context of the analysis was a higher education undergraduate course. A group of students were presented with a discussion topic and were given a series of criteria against which their work would be assessed. At the end of the discussion their dialogue was analysed using three different techniques which were then compared to identify whether any one method could be recommended to other practitioners. Suggestions for evaluation of bulletin board transcripts are made on the basis of this investigation.

The development of discussion boards as learning tools

Discussion boards or bulletin boards are part of a general category of CMC. Discussion boards allow students to interact with one another and with a facilitator and can be used for a variety of teaching techniques designed to stimulate cognitive and metacognitive skills.

An extensive literature base (Harasim, 1990; Mason, 1994) has developed which supports the educational value of CMC as a teaching and learning strategy. However, most investigations into the benefits of this form of interaction have tended to be quantitative in nature (McKenzie & Murphy, 2000; Nastasi & Clements, 1992) concentrating on either the number of exchanges that take place, or on diagrammatic representations of the pattern of interaction between participants. During the last decade however, methods of analysis have been applied to this communication technique to identify more precisely the varied educational dimensions that may be found within the online text (Henri, 1992; Gunwardena et al, 1997). Different forms of 'content analysis' have been developed and refined to aid the categorisation of dialogue produced in any debate or online seminar. MacKinnon and Aylward, (2000) for example, have used a system of coding online dialogue using 'cognotes', where the e-moderator attaches icons to ongoing text in order to indicate the nature of the interactions which are occurring. This is intended to encourage higher student achievement and more positive relationships between the participants.

Aim of study

Currently, content analysis has been seen as a time-consuming activity which, while it can produce valuable insights for educational researchers, does not lend itself to practical application by teachers who might want to evaluate the online discussion element of their programmes. This pilot study seeks to compare the relative strengths and limitations of established content analysis techniques and then propose a simp ler method that is useful and practical. This would then allow course providers to decide whether their course participants are displaying cognitive and metacognitive aspects of learning at the level they expect.

Depth of learning

McLoughlin and Oliver (1998) have indicated that Higher Order Thinking (HOT) is not easy to define but can be recognised when encountered. These authors have summarised recent debate on the definition of

HOT as referring to thinking which is complex, multi-faceted, self-directed and one in which the learner plays an active role (1998, p. 242). This is in line with Sternberg's (1985) theory of intelligence that considers the basis for higher order cognitive processing to be executive processes used in planning, monitoring and decision making. For the purpose of this paper cognitive skills are generally regarded as applying to student understanding, reasoning, and the development of critical thinking and problem solving skills, while metacognition relates to knowledge of one's own cognition and the further regulation of that cognition (Hara, Bonk and Angeli, 2000). Henri and Parer (1992), in addition to their model of content analysis, also identified the level of information processing as 'surface' or 'in-depth'. They recognised surface processing to include: making judgements without justification; stating that one shares opinions already stated; repetition; and irrelevant questions. In-depth processing, Henri stated, was demonstrated when participants linked facts and ideas; offered new elements of information; discussed advantages and disadvantages; and made justified judgements.

The study

A group of 10 adult learners on a higher education programme took part in an online discussion which was an obligatory part of their course assessment. None of these participants had previously experienced online discussion. The asynchronous computer conferencing software used was the discussion board contained within *BlackBoard CourseInfo*, a web course management system. The discussion was entitled: "Integrating technology into education - a constructivist approach". The students were required to take part on at least four occasions in a discussion on the topic within a four-week time frame. The criteria upon which their contributions were assessed in the course were obtained from Campbell's experiences (1999) and were: regularity of contribution, links to the comments of others, sharing of ideas and experiences, and reference to readings or Websites.

Evaluation by content analysis

Content analysis involves comparing, contrasting and categorising elements of written dialogue for meaning, as opposed to discourse analysis which examines the process of communication including specific speech acts. A range of examples of models have been selected for this study including those developed by Henri (1992) and Gunwardena, Lowe and Anderson (1997) and an earlier method of determining the complexity of student responses, the Biggs' SOLO taxonomy (1982). Modifications to these schemes are also incorporated in the analysis, 'since every computer conference will have its own unique attributes, researchers may have to design electronic discussion group evaluation criteria on a case by case basis,' (Hara, Bonk and Angeli, 2000, p.143). In particular the models were chosen to enable higher orders of thinking to be identified in the dialogue, as this is frequently identified as a required outcome in tertiary level education programmes.

Table 1: Gunawardena, Lowe and Anderson content analysis model (1997)

CATEGORIES FOR DATA ANALYSIS	EXAMPLES
Phase 1: Sharing and Comparing	Observations, examples and descriptions, basic agreement
Phase 2: Discovery and exploration of difference	Questions re differences, clarifying statements
Phase 3: Negotiation of meaning and co-construction of knowledge	Identification of common ground, statements of compromise
Phase 4: Testing and revision of ideas	Testing of ideas against personal knowledge
Phase 5: Awareness of newly constructed	Metacognitive statements, reflection

Model 1: Gunawardena, Lowe and Anderson's (1997) criteria for content analysis
This model was originally designed to examine the construction of knowledge within online debates in a similar manner to the design of Nastasi and Clements (1992) who considered that the resolution of cognitive conflict could be used as a measure of cognitive learning. See table 1.

Model 2: Henri and Parer's qualitative criteria for content analysis (1992)

This model identifies five dimensions within the framework of the content analysis: participative, (examined by quantitative analysis), social, interactive, cognitive and, metacognitive. Each of these have operational definitions and related indicators, however only the latter two have been examined in this study as the focus of the study was to analyse participants' learning outcomes rather than the collaborative process of achieving that result. Nevertheless, it is recognised that in a constructivist learning environment, where collaborative learning is occurring in a social setting, interactions between the participants must play a significant role in the achievement of understanding.

Categories for data analysis	Definitions/Indicators
Cognition	
1. Elementary classification	Observing a problem and its linkages, questions, basic descriptions
2. In-depth classification	Analysing a problem re beliefs and assumptions, referential criteria
3. Inferencing	Inducting and deducting (based on prior propositions), generalisations, conclusions
4. Judgment	Making decisions (I agree), appreciations, criticisms
5. Strategy application	Proposing actions, evaluations, decisions
Metacognition	
1. Metacognitive knowledge	Perceptions of oneself as learner and thinker, realisation of strategic knowledge
2. Metacognitive skills	Planning, regulation, evaluation and self-awareness

Table 2: The Henri and Parer content analysis model

Hara, Bonk and Angeli (2000) have added the categories 'reflection' and 'self-questioning' to Henri's list of metacognitive skills and these have been applied in this study. Even with these modifications, metacognition is not often clear, possibly because it occurs infrequently in the discussion being studied.

Model 3 – Biggs's SOLO taxonomy (Biggs and Collis, 1982)

This form of textural analysis, designed primarily for the print-based word, was an earlier attempt to examine the complexity of students' responses. Although it was not designed to function as a model of content analysis, it was trialed in this study to see if Biggs's categories of HOT would provide a useful alternative technique. The outcomes have the advantage of being generic, and provide a fairly clear cut-off between students' surface and deep learning approaches, at a point separating level three from level four.

Level of outcome	Indicators
1. Prestructural	Irrelevant information, no meaningful response
2. Unistructural	Answer focuses on 1 relevant aspect only
3. Multistructural	Several relevant ideas, but not co-ordinated
4. Relational	Integrated, meaning is understood
5. Extended abstract	Answer goes beyond information given.

Table 3: Levels of Biggs's SOLO taxonomy

Method applied in this study

The fifty messages contributed by students, primarily in chronological order, were first listed by dialogue number. Remarks made by the e-moderator were deleted from this list. Initial entries placed on the board during the first face-to-face session were also removed as these did not pertain to the assignment but were designed to familiarise students with the process of contributing.

Following this preparatory stage the three main techniques described above were applied to the whole sequence at an entire dialogue message level. In addition, surface processing compared to in-depth processing following the Henri model was also evaluated. Within each message the category was selected on the basis of the highest order of thinking demonstrated within the dialogue. In other words, messages were not sub-divided into smaller units of meaning. There were three reasons for this; firstly, subdivision

would have simply produced additional data indicating an increased amount of lower value learning levels without affecting the extent to which higher order thinking might be discerned. Secondly, this whole message analysis overcame the problem of deciding where to slice the dialogue to achieve appropriate subsections. Thirdly, it saved a large amount of analytical time. It did however obscure the precise identification of student performance, as described in Gunawardena's model where each of the five phases is categorised in more detail. To increase the rigor of this subjective process a second researcher examined every fifth entry and applied the same series of content analyses to this 20% sample.

Results

All models showed a distribution of rating scores from 1 – 5, with relatively few responses at the higher level of cognition. Table 4, indicating the relative ratings allocated by each model, shows that the Gunawardena model produced a greater proportion of low-level ratings than the other two. In the Henri model metacognitive references were also listed (M) which occurred mainly in the cognition category 5 ratings but also one occasion in the category 4. This table indicates overall comparative frequencies but does not indicate similarities or differences between the models per individual dialogue.

Content analysis rating	Gunawardena	Henri	Biggs
1	24	15	6
2	9	16	8
3	9	8	16
4	6	5 + 1M	15
5	2	6 + 3M	5

Table 4: Content analysis rating scores for all three models

To examine whether the three models did show consistency between the individual ratings a simple correlation analysis was applied to show degrees of association or similarities between them all (see Table 5).

	Gunawardena	Henri
Gunawardena	-	-
Henri	.7405	-
Biggs	.6624	.7025

Table 5: Correlation Coefficient between content analysis models

Table 5 shows that there is a strong correlation between the Henri and Gunawardena models and a lower one between the Gunawardena and the Biggs analyses. The reason for this difference is that results from the Gunawardena rating allocate 50% extra scores at the lower end of the learning level scale in comparison to Biggs (see Table 4). Nevertheless, all three models do show statistically strong degrees of correlation.

Conclusions

Two main conclusions can be drawn from this study. Firstly, practitioners wanting to apply one of these models will be able to do so quite readily if they select their categories at the level of the whole message, rather than sub-categorising the text. The consistent application of any appropriate technique will then indicate levels of HOT in their own online discussions which can then be used for modifying teaching techniques.

Secondly, the nature of the discussion and the expectations of the course providers should determine the choice of the primary model selected. If the aim is to encourage a collaborative learning environment, then the Gunawardena model provides more insight into whether or not that has been achieved. This model also incorporates metacognition into the main framework, which is essential if any evaluation of HOT is

required. The Henri model, with its metacognitive aspect applied as a separate framework dimension tends to highlight individuals' success in displaying internal cognition in a more Piagetian sense, although within some of her categories there are opportunities to acknowledge the interactive nature of the discussions. A major criticism of Henri's model (McLoughlin and Luca, 1999, p.223) is that 'it was designed for contexts where there was a strong teacher presence, and is not readily applicable to a learner-centred conferencing environment'. These authors consider that the Gunwardena model a more suitable tool for reflecting collaborative and social factors, on the basis that it proposes a social constructivist approach to knowledge building in a online environment.

In the Biggs model the categories are clearly hierarchical which leads to an overall value judgement about the content of each message. This rules out completely the possibility that socially interactive functions are acknowledged as part of cognitive development. Although all three are structured to indicate levels of learning and deeper understanding demonstrated by the text, it is only the Gunawardena cognition model that relates this achievement to the degree of collaboration demonstrated.

In considering what model to apply and what modifications might be required, the nature of the student body should also be taken into account. The learning style of participants is one issue that should be considered and 'it is suggested that current research literature in the area of learning styles and strategies can provide instructional designers with insights into differences in learning and performance that can be factored into the design process' (McLoughlin, 1999, p. 223). Research has shown (Klemm and Snell, 1996) that unless discussions are summatively assessed, dialogue will be minimal. It might be asked if instructional designers are merely providing increasingly elegant hoops for learners to jump through.

Summary

The significance of this paper is that it should encourage online teachers to develop more effective teaching techniques by enabling them to evaluate the effects that their own online practices play in students' cognition and metacognition. A summary of the analysis approach for online transcripts can be summarised in there steps, and requires the selection of a content analysis approach that is congruent with the intended learning outcomes and pedagogy of the course of study.

The three stages for analysis are as follows:

1. First, analyse dialogue content at whole message level.
2. Second, allocate a rating according to highest level of thinking evidenced in message (See for example the scheme proposed by McLoughlin & Oliver, 1998).
3. Third, select or modify a content analysis technique that reflects the philosophy of the course in respect of student learning outcomes and pedagogy.

Data analysis and coding of transcripts can then be carried out to determine the forms of thinking and cognitive skills that are embedded in the dialogue.

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