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Abstract This report presents a literature review on pedagogical perspectives of argumentation and moderation of online discussions. Starting with a review of argument theory this report discusses several perspectives on argumentation, followed by presenting a dialogic alternative. The next part discusses the literature on moderation of online discussions, which is followed by section three on the use of KWIC and KAIC methods to quickly find key words and key actions featuring an online discussion as a way to assist moderators. Based on these three sections a set of awareness indicators are proposed to assess and evaluate the quality of online dialogues, which are presented in section 4. The final part of this report presents a methodology which can be used to research and evaluate online discussions.

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SUMMARY

This report presents a literature review on pedagogical perspectives of argumentation and moderation of online discussions. Starting with a review of argument theory this report discusses several perspectives on argumentation, followed by presenting a dialogic approach to understanding educational dialogues. The next part discusses the literature on moderation of online discussions, which is followed by section three on the use of KWIC and KAIC methods to quickly find key words and key actions featuring an online discussion as a way to assist moderators. Based on these three sections a set of awareness indicators are proposed to assess and evaluate the quality of online dialogues, which are presented in section 4. The final part of this report presents a methodology which can be used to research and evaluate online discussions.

INTRODUCTION

This report is the first deliverable of this work package (WP 5) and aims to present the project with a review of the research literature on educational dialogues and moderation of online discussions. One could see this review as a ‘baseline’ informing the ARGUNAUT project about the current state of research in this area and use this knowledge to build on when developing awareness tools for moderators and a set of criteria and methodology to evaluate online discussions. As such this deliverable in particular feeds in to the work carried out work package 4 (developing awareness indicators for the deep loop) and 6 (laying out a methodology to design the experiments).

One of the main aims of ARGUNAUT is to promote high-quality online discussions for learning in an educational setting. This raises the question: what is ‘quality’ in educational dialogue and how can we assess this quality using discourse analysis?’ We will begin with an account of some of the perspectives in argument theory that have been applied to educational contexts from a more formal analysis and then move on to a more recent dialogic approach that has emerged from empirical studies in classroom. Section 2 discusses online moderation and presents an overview of contemporary research findings on teaching online. The next section introduces the KWIC and KAIC approach to assist discourse analysis based on key words and key actions featuring the online discussion. We then propose a first set of ‘indicators’ used to assess the quality of online discussions. We end this report by presenting a multi-method research methodology that can be applied as a framework for designing the pedagogical experiments.

1. UNDERSTANDING EDUCATIONAL DIALOGUES

In this section we discuss how studies in educational dialogues have been dominated by formal argument theory based research at first, but opened up, under the influence of more empirical research in classrooms, to more situated humanistic approaches aimed at understanding ‘living’ dialogues.

1.1 Argument theory

Argument theory has been influential in studies of Computer Supported Collaborative Learning (e.g. Andriessen, Baker and Suthers, 2003; Ravenscroft and McAllister, 2006). The roots of argument theory lie in philosophy and conceptual analysis rather than in empirical educational research. Following this tradition argument theory has focussed on the structure and syntax of arguments.

1.1.1 Toulmin's argument schema

Toulmin, whose account of informal argument has been very influential in education, offers a good illustration of this approach to argument which treats it as if it was a kind of 'grammar' (Toulmin, 1958). Criticizing over formal and over abstract accounts of good and bad arguments in terms of logical syllogisms rather than ordinary language, Toulmin introduced a description of what he called 'informal logic'. His terminology such as 'warrant' suggests that his perspective was influenced by the kind of argumentation used by lawyers to persuade the judge or jury in courtrooms. His account broke argumentation down into the following moves:

- A *claim* states the standpoint or conclusion, for example: "The Kyoto protocol to reduce global warming is necessary."
- The *data* are the facts or opinions that the claim is based on, for example: "Over the last century, the earth's temperature has been rising as a result of greenhouse gas emissions."
- The *warrant* provides the justification for using the data as support for the claim, for example: "Scientists agree that there is no other explanation for this rise in temperature."
- Optionally, the *backing* provides specific information supporting the warrant, for example: "Scientists have identified the atmospheric mechanisms whereby greenhouse gases cause a warming of the earth's surface."
- A *qualifier* adds a degree of certainty to the conclusion, indicating the degree of force, which the arguers attribute to a claim, for example: "However, the earth's temperature has been found to fluctuate over geological time, in some cases without any obvious cause."
- Exceptions to the claim are expressed by a *rebuttal*, for example: "The Kyoto protocol would not be necessary if the world's countries voluntarily reduced their output of greenhouse gases." (Examples taken from Andriessen, 2006)

1.1.2 Van Eemeren & Grootendorst's 'pragma-dialectics'

Van Eemeren & Grootendorst (1999, 2004) criticize Toulmin for failing to take into account the fact that an argument always has, or so they claim, two sides, that of a proponent and that of an opponent. Toulmin, they write, gives the perspective of the proponent of an argument ignoring the contribution of the opponent. They build on the work of Toulmin, and the speech act theory of Searle (1965) and Austin (1962), which concerns itself with 'pragmatics' or how utterances do things such as persuading people, but they make this kind of analysis more 'dialectical' by locating it in a conversation between two people. The ideal conversation, according to Van Eemeren and Grootendorst, proceeds in four stages:

1. Confrontation, in which the two people verbalize a difference of opinion,
2. Opening, in which they agree on procedural and substantive starting points for resolving this difference of opinion,
3. Argumentation, in which argumentation is advanced and responded to, and :

4. Conclusion, in which the parties decide jointly whether and how their difference of opinion has been resolved.

In the simplest case, for example, one person may express doubt about an assertion. It is then the task of the other in the dialogue, the “protagonist”, to justify the assertion to the satisfaction of that person, the “antagonist”, using the starting points agreed to at the opening stage.

Following in the tradition of Grice’s (1975) work on the implicit rules of conversation in general, Van Eemeren and Grootendorst (1992) propose ten rules for the conduct of argumentation as a type of conversation, a type which they call a “critical discussion”. These ten rules are as follows:

1. Parties must not prevent each other from advancing standpoints or casting doubt on standpoints.
2. A party that advances a standpoint is obliged to defend it if the other party asks him to do so.
3. A party's attack on a standpoint must relate to the standpoint that has indeed been advanced by the other party.
4. A party may defend his standpoint only by advancing argumentation relating to that standpoint.
5. A party may not falsely present something as a premise that has been left unexpressed by the other party or deny a premise that he himself has left implicit.
6. A party may not falsely present a premise as an accepted starting point nor deny a premise representing an accepted starting point.
7. A party may not regard a standpoint as conclusively defended if the defense does not take place by means of an appropriate argumentation scheme that is correctly applied.
8. In his argumentation, a party may only use arguments that are logically valid or capable of being validated by making explicit one or more unexpressed premises.
9. A failed defense of a standpoint must result in the party that put forward the standpoint retracting it, and a conclusive defense of the standpoint must result in the other party retracting his doubt about the standpoint.
10. A party must not use formulations that are insufficiently clear or confusingly ambiguous and he must interpret the other party's formulations as carefully and accurately as possible.

According to van Eemeren a fallacy is a violation of one of the ten rules. Generically, such fallacies are moves which disrupt or “derail” the process of rationally resolving an expressed difference of opinion.

1.1.3 Walton’s dialogue theory

Walton locates argument within the broader concept of dialogue. A dialogue, he writes, is ‘a verbal exchange between two parties, according to some kind of rules, conventions or expectations’ (Walton, 2000). He continues in the Aristotelian tradition of ‘formal studies’ of dialogue based on conceptual analysis rather than empirical study. Walton quotes Hamblin to the effect that the formal study of dialogue “consists in the setting up of simple systems of precise but not necessarily realistic rules, and the plotting out of the properties of the dialogues that might be played out in accordance with them.” (Hamblin, 1970, p. 256). Whilst in actual dialogues it is not always clear what the rules are in Walton’s formal dialogues the rules are laid down precisely. The idea is that this formal analysis of types of dialogue can be a useful framework for analysing actual dialogues.

He presents his classification of formal types of dialogue in *The New Dialectic* (Walton, 2000). The new dialectic classifies many different types of dialogue that represent different kinds of goal-directed conversations in which argumentation is used to contribute to the goal of the dialogue. Six basic types of dialogue are described in the new dialectic. The properties of these six types of dialogue are summarized in Table 1.

TYPE OF DIALOGUE	INITIAL SITUATION	PARTICIPANT'S GOAL	GOAL OF DIALOGUE
Persuasion	Conflict of Opinions	Persuade Other Party	Resolve or Clarify Issue
Inquiry	Need to Have Proof	Find and Verify Evidence	Prove (Disprove) Hypothesis
Negotiation	Conflict of Interests	Get What You Most Want	Reasonable Settlement that Both Can Live With
Information-Seeking	Need Information	Acquire or Give Information	Exchange Information
Deliberation	Dilemma or Practical Choice	Co-ordinate Goals and Actions	Decide Best Available Course of Action
Eristic	Personal Conflict	Verbally Hit Out at Opponent	Reveal Deeper Basis of Conflict

Table 1. Types of dialogue according to Walton (2000)

Argumentation, for Walton, rather as for Socrates in the *Meno*, consists in that the one party takes the commitments of the other as premises, and then by a series of steps of inference, uses these premises in arguments that aim towards proving an ultimate conclusion to the other party. Although he describes several types of argumentative dialogue they are all then really variations on persuasion.

Interestingly for the purposes of ARGUNAUT, Walton thinks that the results of a formal analysis of dialogues can be applied to real dialogues in order to assess their quality. He writes: 'Each type of dialogue is used as a normative model that provides the standards for judging how a given argument should be correctly used in a given case'.

1.1.4 Baker's learning mechanisms

All of these traditions arise in conceptual analysis or formal analysis of argument rather than as the findings of empirical studies. Baker (2004), builds upon the tradition of argument theory

but in the context of empirical studies of online dialogues. This enables him to identify four benefits or 'learning mechanisms' that may result from engaging in explicit argumentation:

- Making knowledge explicit (L'explicitation des connaissances): Learners that provide explanations, or make explicit the reasoning underlying their problem solving behavior, show the most learning benefits (Chi & van Lehn, 1991). Argumentation provides many opportunities for explanation, and preparing a justification or argumentative defense fosters reflection that often leads to deeper learning.
- Conceptual change (Les changements d'attitudes épistémiques): Debating a question may raise doubt about initial misconceptions. Conceptual transformation is supported by argumentation.
- Co-elaboration of new knowledge (La co-élaboration de nouvelles connaissances): In argumentation, learners work together to develop new knowledge. The interactive interpersonal nature of verbal interaction helps to scaffold individual learning.
- Increasing articulation and clarification of implicit concepts (le changement conceptuel): Argumentation obliges learners to precisely formulate question and statements, and articulation transforms and deepens during the argument. (Baker, 2004, p100-101)

1.1.5 Knowledge Building and progressive inquiry

Similar to Baker's learning mechanisms on online dialogue, Scardamalia and Bereiter (1992) developed a framework for learning and knowledge construction through online social dialogues called knowledge building. Knowledge building takes place in social settings or communities which are familiar to scientific research communities and operate based on constructivist principles (knowledge is a human construction and not something that is to be revealed or transmitted), sociocultural activity (as the medium through which knowledge construction takes place) and apprenticeship (skills of young scientists are acquired by working with a more mature scientist). Scardamalia and Bereiter developed a networked learning environment called CSILE (computer-supported intentional learning environments) that embedded the following knowledge building principles to support online dialogue (Scardamalia and Bereiter, 1992, p. 44-46):

- Objectification. Treat knowledge as objects that can be criticized, modified, compared and related, and regarded from different viewpoints, in different contexts.
- Progress. Knowledge building should lead somewhere and progress should be perceptible to students
- Synthesis. Encourage higher order representations and integrations of knowledge rather than the proliferation of loosely connected items
- Consequence. Something nice should happen to students as a result of knowledge building operations
- Contribution. Contributions to the communal database should be visible, not solely in terms of their independent merits, but also to their contribution to advancement of the group's knowledge
- Cross-fertilization. Maximize changes for students to come into contact with related ideas, kindred spirits, and useful information, unrestricted by boundaries of space and category
- Social. There should be no discontinuities between work in CSILE and other curricular activities

The central activity of knowledge building is aimed at progressive discourse related to advancement of knowledge. Hakkarainen (1998) developed a pedagogical model called

progressive inquiry (PI) to facilitate this process. PI engages members of a knowledge building community in a step-by-step process of question and explanation-driven inquiry (Muukonen, Hakkarainen & Lakkala, 1999). PI consists of the following elements (Muukonen, Hakkarainen & Lakkala, 1999):

- **Context:** The participants in a PI structured activity commence by creating the context. To be able to explore the problem more deeply, members have to become familiar with it. A context is first created in order to clarify why the issues in question are relevant and worthwhile to investigate. In this way the community develops a body of understanding that serves as an anchor for the formulation of the problem statement or research question.
- **Questions:** Scientific inquiry, which is used as the basis of this model, can be seen as a problem solving process. Initial questions guide and direct the search for information.
- **Brainstorm:** Once the community has agreed on an initial research question, the members are invited to construct their own interpretation. In this phase the participants have a brainstorm session to present and construct personal working theories. The participants are stimulated to use their background knowledge to offer a first explanation for the problem. In this phase a first 'knowledge base' of the community's understanding of the problem has been created. This knowledge base (or inventory of distributed expertise) needs to be evaluated.
- **Critical evaluation:** Evaluation is an important next step to assess advancement in the theories or explanations being offered. Through an evaluation of whether, and how well, the working theories explain the chosen problems, the community can assess the strengths and weaknesses of different explanations and identify contradictory explanations and gaps of knowledge.
- **Deepening:** The next step is to search for deepening knowledge. Considerable advancement of the inquiry cannot be made without obtaining further, new information. By re-examining prior problem statements or working theories, with the help of new information, the community may become aware of their inadequate pre-suppositions. New information may help them to reconstruct their conceptual understanding of the problem.
- **Structuring:** Progressive inquiry is a process of further refinement and structuring of the collective understanding of the problem. At first the community has a broad conception of the problem that leads to general questions. After making an inventory of prior knowledge, and searching for new information, more specific questions may emerge. Advancement of the inquiry is procured by developing a chain of (deepening) questions.
- **Concluding:** In the last phase the community, by finding answers to subordinate questions, approaches step-by-step toward a fuller answering of the initial question or problem statement.
- **Shared Understanding:** This is the most central element of PI activity. Knowledge building is a social process aimed at advancing knowledge through active engagement in the learning activity by all members of the community. By explicitly working towards a shared understanding of the problem at each stage during their dialogue the members are able to construct knowledge collaboratively and in doing so advance the knowledge of the individual as well the entire community.

1.2 The dialogic alternative

Andriessen (2006) and Scardamalia and Bereiter (1992) presents developments in argumentation theory as moving from abstract and formal studies towards taking the empirical reality of human dialogues into account. However it is clear that Van Eemeren and

Grootendorst's 'Pragma-Dialectics' and Walton's 'dialogue theory' remain highly idealised and formalised accounts that are imposed on real situated dialogues rather than emerging from them. As opposed to 'dialectics', which always begins as a theory of argument, Bakhtin's (1981) 'dialogic' approach begins with embodied, situated 'living' dialogues.

Dialogicality means not merely that participants in interactions respond to what other participants do, they respond in a way that takes into account how they think other people are going to respond to them. Rommetveit, quoting Barwise and Perry (1983), calls this circularity 'atunement to the atunement of the other' (Rommetveit, 1992). This mutual atunement means, as Rommetveit brings out, that we cannot understand utterances or communicative actions outside of their context in a dialogue and also that the context is indeterminate being an infinite or unbounded chain of possible interpretations.

Historically reason has been codified in various ways that have not taken dialogical circularity into account. This is obviously true of accounts of argument found in formal logic but it is equally true of the various formal accounts of argumentation described above. In the monological paradigm it is normal to see models as a way of getting a handle on reality which we can use to inform interventions that change things. Models of reason have served precisely this purpose in education. Walton, for example, quoted above, is happy that his formal models of argumentation, dreamt up in his study, are applied to real, holistic and situated dialogues in order to serve as a measure of their quality. For those who adopt the assumptions of the dialogical paradigm, on the other hand, the role of models is not so straightforward.

Wegerif argues that a useful dialogic model of higher order thinking has emerged from detailed empirical research on the quality of dialogues in classrooms (Wegerif, 2002). His model focuses on two aspects of dialogue, intersubjective orientations and shared ground rules.

1.2.1 Intersubjective orientations

Habermas begins his account of communicative rationality by drawing a distinction between 'a success-oriented attitude' and 'an attitude oriented to reaching understanding' (Habermas 1991, p 286). While he does not dismiss the strategic or profit-maximising rationality that issues from a success-oriented attitude he argues that this kind of rationality is parasitic on a more fundamental communicative rationality issuing from an attitude oriented to reaching understanding. Use of the word 'attitude' carries with it the danger of being interpreted as only referring to individual states whereas Habermas makes it clear that he is referring to ways in which participants in a dialogue can orient themselves to each other. He refers to this as the 'structural properties' of intersubjectivity. To emphasise this we will use the term 'intersubjective orientation' in place of attitude.

Habermas is not generally seen as a dialogic thinker but his claim about the centrality of intersubjective orientations connects his later work to the very different tradition of Jewish writer and theologian, Martin Buber. Buber draws a distinction between the 'I-thou' type of relationship, characterised by mutual responsiveness, and 'I-it' relationships in which an active subject confronts and dominates a passive object (Buber, 1923/70). Bakhtin was familiar with Buber and he makes a similar distinction when he contrasts the 'authoritative' voice, that demands that we either accept or reject it to the 'persuasive' voice (Bakhtin, 1934/81 p343) that enters into us and stimulates our own answering words.

1.2.2 Shared ground rules

Buber's 'I-thou' relationship might be a pre-condition for the emergence of reason, as Hobson (2002) claims, but it is not, in itself, reasoning. In Habermas's account of communicative rationality a second level of description of reason is often referred to as the

social rules governing what he calls an 'ideal speech situation'. Habermas takes up rules first proposed by Robert Alexy as "the Rules of Reason" (Habermas, 1990, 165-167). In Habermas's formulation, these are:

1. Every subject with the competence to speak and act is allowed to take part in a discourse.
- 2a. Everyone is allowed to question any assertion whatever.
- 2b. Everyone is allowed to introduce any assertion whatever into the discourse.
- 2c. Everyone is allowed to express his attitudes, desires, and needs.
3. No speaker may be prevented, by internal or external coercion, from exercising his rights as laid down in (1) and (2).

These particular rules have been criticised by Seyla BenHabib and others as being too formal. Benhabib's claim is that reasonableness stems not from the abstract rights of a universal other but from recognising the needs of a concrete other (BenHabib, 1992) which presupposes an attitude of care not mentioned by Habermas. But while Habermas can be challenged on the details his important insight here is that we need shared social rules to open up a space for thinking between the Scylla of coercion on the one side and the Charybdis of unreflective consensus on the other.

1.2.3 'Exploratory talk' as a dialogical model

So far we have argued, through a discussion of the literature that dialogical models of reason require at least two levels of analysis: an account of intersubjective orientations and an account of social ground rules followed in an interaction. This can be illustrated more concretely in the idea of 'Exploratory Talk' that has been influential in education in the United Kingdom since the 1970's (Barnes and Todd, 1978). The concept of Exploratory Talk was first put forward by Douglas Barnes and has more recently been developed and championed by Neil Mercer. Unlike the more formal analyses of argumentation theory and of Habermas, Exploratory Talk emerged from empirical studies of classroom dialogues. Exploratory Talk is presented by Mercer (1995) as arising in the context of a characterisation of three 'types of talk' found empirically in a study of collaborative learning in classrooms. The three 'types of talk' described by Mercer can also, as a later article made clear (Wegerif and Mercer, 1997) be seen as reflecting orientations of the kind that Habermas referred to as 'structural properties of intersubjectivity'. The three 'types of talk' Mercer refers to are (Wegerif and Mercer, 1997):

- Disputational talk, which is characterised by disagreement and individualised decision making. There are few attempts to pool resources, or to offer constructive criticism of suggestions. Disputational talk also has some characteristic discourse features - short exchanges consisting of assertions and challenges or counter assertions.
- Cumulative talk, in which speakers build positively but uncritically on what the other has said. Partners use talk to construct a 'common knowledge' by accumulation. Cumulative discourse is characterised by repetitions, confirmations and elaborations.
- Exploratory talk, in which partners engage critically but constructively with each other's ideas. Statements and suggestions are offered for joint consideration. These may be challenged and counter-challenged, but challenges are justified and alternative hypotheses are offered (cf. Barnes and Todd, 1978). Compared with the other two types, in exploratory talk knowledge is made more publicly accountable and reasoning is more visible in the talk.

This analytic framework has sometimes been interpreted as a coding scheme which all utterances or other chunks of talk can be made to fit. It was intended rather differently as a loose analytic framework arising from the intuitions of practitioners and of use as a heuristic

by practitioners. When teachers look at a group in their class and listen briefly they have to judge quickly and roughly how they are getting along. In order to do this they do not have the time and resources to code all the utterances but they can assess, as experienced participants in dialogues, the kind of relationship embodied in the talk, whether that is cumulative, disputational or exploratory. In other words the types of talk schema is not a classification at the level of words, utterances or even, ground rules, but at the level of intersubjective orientations intuited by participant observers.

To understand the nature of the distinctions being made in the classification of 'types of talk' it is worth briefly considering what happens when there is a transition in the type of talk. We are probably all intuitively familiar, as participants, with the possibility of abrupt transitions in dialogues: for example, a shift from a cooperative enquiry into personal competition when something said suddenly pulls us back from open participation into an acute awareness of our own separate identity and separate interests and the need for these to be defended. The fact that such transitions occur and are recognised by participants suggests that types of dialogue defined through intersubjective relation have a certain reality within dialogues. Although such 'types of talk' have measurable externally observable effects on features of the dialogue such as the words spoken (the number of 'because's' or other logical connectors for example), the tone of voice, the length of pauses or the eyebrows raised, they are not reducible to these surface effects.

Of the three types of dialogue referred to above the one closest to traditional ideas of rationality, is exploratory talk. This combines features of cumulative talk, being a kind of cooperation, with features of disputational talk, because it includes challenges and competition. However, the competition in exploratory talk is between ideas not between people. A key indicator of an exploratory orientation is that participants are able to change their minds in response to good arguments. In the light of the previous discussion of intersubjective orientations it seems that an exploratory orientation is a development from a what Habermas would call a 'communicative' orientation with social ground rules which establish a relationship of trust and co-operation within which participants seek to understand each other rather than to manipulate each other.

The pedagogical application of Exploratory Talk involved elaborating the idea of an Exploratory type of talk (or intersubjective orientation) into 'social ground rules' appropriate for the specific social context of classrooms. The list of these rules presented in an article by Mercer and Wegerif in 1997 is not fixed or final but gives a fairly good idea of what is meant by a 'social ground rule' and what is meant by 'Exploratory Talk':

- All relevant information is shared
- The group seeks to reach agreement
- The group takes responsibility for decisions
- Reasons are expected
- Challenges are accepted
- Alternatives are discussed before a decision is taken
- All in the group are encouraged to speak by other group members

The first three rules in the list are ground rules that are shared with cumulative talk; rules that serve to bind the group, share information together and construct knowledge together through seeking agreement. Rules four and five focus on the explicit reasoning that characterises exploratory talk as opposed to other types of talk. The role of challenges was seen as important in distinguishing between cumulative, disputational and exploratory orientations. In exploratory talk challenges stimulate joint reasoning, while in cumulative talk they are experienced as disruptive and often lead to a loss of cooperation and a switch into disputational talk. In disputational talk participants may still offer arguments but are in fact focusing on 'winning' rather than on understanding or solving a problem together.

In keeping with the dialogic basis of this approach these ground rules are not imposed but used as a heuristic for teacher training, actual ground rules then being negotiated within each class and re-negotiated frequently, at least each term.

The schema can be operationalised quite simply through four levels of analysis:

1. intersubjective orientations, cumulative, exploratory, disputational etc are realised in different social contexts by different sets of;
2. social ground rules such as responding to challenges with reasons and seeking agreement, which in turn are realized by typical;
3. communicative acts and exchanges such as ‘why’ questions and ‘because...’ answers and these acts are realized in;
4. measurable surface features of the dialogue such as number and length of utterances and the use of key words.

Key Word in Context (KWIC) analysis operates on level 4 while Key Action in Context (KAIC) analysis operates on level 3 (KWIC and KAIC are described in more detail below in section 3). This kind of analysis does not directly assess the intersubjective orientation but it does offer supportive indicators of different intersubjective orientations.

1.2.4 Creativity and reflection

Thinking about reason from a dialogical perspective shifts the focus of attention away from abstract cognitive structures and towards the way that people respond to each other in dialogues. Exploratory Talk is a model of higher order thinking embodied in a type of dialogue consisting of an intersubjective orientation and a set of ground rules specifically designed to support collaboration in the classroom. This model has proved an effective support for teachers. Its implementation resulted in a significant improvement in the quality of collaborative learning and reasoning according to a range of measures (Wegerif, 2005: Mercer, 2000). However, while Exploratory Talk is a dialogical model of a kind of reason, the focus in its definition on explicit reasoning links it to the tradition of argumentation discussed above. This is a limitation because many accounts of higher order thinking in education such as that of Resnick (1987) stress the central role of creative thinking. Empirical evidence suggests that in practice creativity is important to the quality even those dialogues seeking to solve reasoning test problems, and this creativity is not necessarily supported by the learning mechanisms of explicit reasoning mentioned earlier but can be supported by certain kinds of dialogue that open up a ‘reflective space’ which supports the open exploration of possibilities (Rojas-Drummond et al in press; Wegerif, 2005).

The increasing centrality of creativity in accounts of quality in educational dialogues challenges the three types of talk schema outlined originally by Mercer. This remains true even if we include, as Wegerif proposes, a fourth type of talk: playful talk (Wegerif, 2005). We need to understand higher order thinking in embodied terms as a kind of dialogue but in broader terms than the explicit reasoning of Exploratory Talk in order to include the creativity found in more playful dialogue. Bakhtin characterised dialogues as shared enquiry such that ‘If an answer does not give rise to a new question from itself, it falls out of the dialogue’. What is outside of dialogue is, he suggests, meaningless impersonal ‘systemic cognition’ (Bakhtin, 1986, p 168). This definition of dialogue then, corresponds in one respect to higher order thinking as defined by Resnick: it is not algorithmic and in so far as something is a matter of purely formal reasoning that can be programmed and applied then, by definition, it is not ‘higher order thinking’.

This focus on a questioning attitude relates Bakhtin’s account of dialogue to Dewey’s account of reflection as:

An active persistent and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusion to which it tends.(Dewey, 1933)

Interestingly Dewey also seems to have developed the idea of dialogicality which he referred to as ‘transactive’ as opposed to merely ‘interactive’. The definition of a transactive discussion is, “reasoning that operates on the reasoning of another” (Berkowitz & Gibbs, 1983 citing Dewey & Bentley, 1949).

Reflective ‘transactive’ dialogue as shared enquiry, offers a holistic image of embodied higher order thinking. However within the complex and changing whole of dialogue there are many regions, levels and dimensions. Burbules brings out the importance of the dimension of criticality or how skeptically or supportively participants respond to suggestions (Burbules, 1993). This dimension can be seen in the distinction between the more critical ‘exploratory talk’ and more creative ‘playful talk’. Group creativity, does not thrive on explicit critical challenges since participants need to be encouraged to develop their insights in an atmosphere of empathy and trust. This distinction maps a division that Lipman, the founder of Philosophy for Children, one of the most successful and positively evaluated dialogue-based thinking skills programmes in education, makes between the three dimensions of thinking that, he claims, all overlap and contribute to the ideal type of thinking which he refers to as ‘multi-dimensional thinking’ by which presumably he means the kind of ‘philosophical enquiry’ his method promotes. These three dimensions, which he presents in a Venn diagram, are ‘creative thinking, critical thinking and caring thinking’.

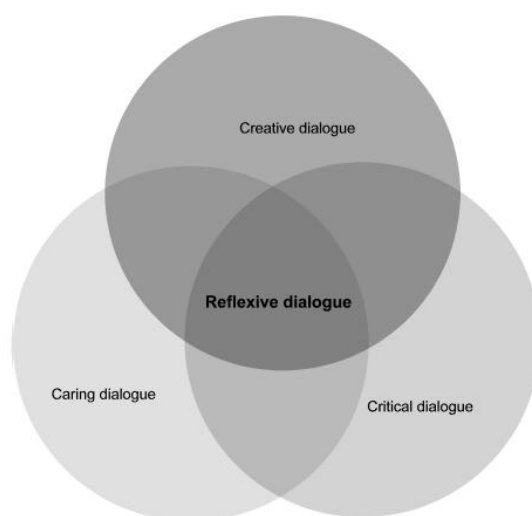


Figure 1. Three dimensions of dialogue (adapted from Lipman, 2003)

The caring dimension, Lipman argues, is not just about having empathy for the perspectives of the others in the discussion, although that is important, but is also about caring for the subject matter under discussion.

Wegerif (in press) argues that these three dimensions can be translated into dialogues with different characteristic ground rules as well as some basic ground rules overlapping. Three ‘dialogue games’ corresponding to these three dimensions have been implemented in an online environment in ongoing research. All dialogues share some ground rules, these shared ground

rules are located in the central part of the Venn diagram. Critical dialogue is embodied in dialogues with an emphasis on explicit challenges and explicit reasoning. Creative dialogue is embodied in dialogues which open up a reflective space in which issues can be explored with encouragement and trust rather than challenges and explicit reasons. Brainstorming is a useful tool within creative dialogue, for example, during which even implicit judgment is meant to be suspended. Caring or empathetic dialogue also suspends critical judgment about others in order to work harder to bring out the distinctive otherness of the other. The focus in caring dialogue is not on creating or on judging but on listening and understanding. This is very similar to the claims made for client centred psychotherapy dialogues (Rogers, 1961). Lipman wanted his category of caring to be as much about topics as about other people in the dialogue but, following a lead given by Buber in his discussion of how we relate to trees, a respectful and responsive attitude towards the otherness of the other person can also be applied to the otherness of areas of non-human reality (Buber, 1923/1970). These three types of dialogue, creative, critical and caring, are embodied thinking skills. Caring or empathetic dialogue is needed for understanding the other in ethnography for example. Creative dialogue is important for open-ended design tasks. Critical dialogue is necessary for solving defined problems and making judgments where the key alternatives and variables are already known.

Although it is a complex whole dialogue can be analyzed into component 'moments' which, although they should never be abstracted too far from the real dialogues that give them meaning, nonetheless can sometimes usefully be made the focus of teaching. One of the great strengths of Philosophy for Children, for example, has been to abstract out the skill of asking intellectually fruitful questions, a component skill of dialogue in general, and focus extra attention on this skill with time spent constructing good questions collaboratively and considering what makes a good question. Other moments in dialogues that can be identified as dialogic thinking skills are listening to and understanding the point of view of the other (comprehension), expressing a perspective persuasively and coherently as a resource for others (construction) and synthesising or 'weaving' the sense of the dialogue as a whole, not only after the event but also in the act of thinking and learning (synthesising). These are dialogic versions of some of Bloom's (1956) general skills of analysis, synthesis and evaluation. More specific skills are required for dialogues with more specific tasks.

2. MODERATION

The first part of this literature review presented an overview of the developments in thinking about and studying educational dialogues. Another important part of this review is to look into the role of moderation and the needs and expectations teachers and students have when engaged in online educational dialogues.

The aim of Argonaut is to develop a system that helps moderators to facilitate online discussions. To us it seems helpful and sometimes more functional to push the discussion in the direction of what is good moderating (and not only what is a good discussion) and extend our understanding of how moderators operate. Moderation is an act of a constant interpretation of the ongoing activities in relation to expected actions by the group. These interpretations are for example influenced by, individual/group behaviour, group configuration and expertise of its members, experience and ability to engage in online discussions, signs of learning and development, engagement shown by its participants, and the development of tasks and roles during the dialogic process.

2.1 Models for online teaching and moderation

At the moment there is a lot of ambiguity about how best to moderate online discussions. “In the literature there is a growing understanding that teaching online is different from teaching face-to-face and as such needs its own set of pedagogies to guide the online teacher (Goodyear, 2002). Teaching styles developed during face-to-face teaching cannot simply be transferred to an online learning environment and it is important to develop an insight in the complex online teaching processes and strategies to build the necessary skills and competencies to teach online (Harasim, Hiltz, Teles, & Turoff, 1997; Stephenson, 2001). In general online teaching activities are to design, facilitate and direct the cognitive and social process for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes (Anderson et al., 2001, see table 2 for a summary). As such this sounds like nothing new, but the way these tasks are embodied and executed in a networked learning environment bids for a re-orientation. Following these three main activities, Goodyear et al. (2001) suggest eight roles of online teaching (see table 1). Not all of these roles have equal importance and some might not even be used in every situation but in general they describe a wide range of competencies and skills online teachers need. When it comes to the design and organization of a networked learning comes, Goodyear et al. (2001) suggest that the teacher has to be able to specify the right online learning activities to fit the course needs and have knowledge of the appropriate pedagogies to create and support the online activities. The teacher has to be able to show the relevance between the activities and its desired outcomes and select the appropriate media accordingly. During the course the teacher has to be able to manage student enrolment and participation, and use online techniques to monitor learning processes to be able to ensure the authenticity of students work. To facilitate the networked learning event the teacher needs to demonstrate self-confidence and a willingness to be open. Challenge all the students to participate, but support them individually and as group at the same time. A certain ambiguity here needs to be tolerated. The teacher must help the students to articulate their learning concerns and needs in order to make them responsible for their own learning and that of others. This way a student-centered environment can be created and supported and a sense of community can be established. Working with appropriate group dynamics to support the community is a particular relevant competency. The teacher should help to pace the learning process and reinforce students’ contributions. Make summaries of key points in the discussion and guide the discussion to keep it within the course goals and objectives. This way the teacher can intervene to provide direction, give information, and manage disagreement. The instruction part of online teaching is concerned with providing the appropriate knowledge and resources needed to generate and offer course content. The teacher should therefore also act as a researcher to stay up to date, not only with the development of the subject matter of the course but also with new teaching models and pedagogies to improve one’s own teaching.

Harasim et al. (1997) suggest that an online teacher plans the coming activities, follows the flow of the conversation, and offers guidance when needed. The teacher provides a set of group structures that enable students to work out a problem or undertake a task, develop strategies to regulate and coordinate their own (collaborative) learning; and the teacher needs to be present, but play a background role. Typical activities are: setting the stage by developing a warm environment and providing clear directions and support structures; monitor and encourage participation by following student activity and make expectations clear and model responsiveness; forming groups and assigning role responsibilities using appropriate pedagogical (collaborative) models; moderate and facilitate group processes by coordinating interaction, scheduling and organizing the structure of the interaction, and provide social and emotional support); and establish norms and grade performance. Mason (2001) states that for successful facilitation the following categories needs to be considered: the setting must be

appropriate for online learning; course design needs to be well structured to avoid overload and assist navigation through resources; teacher needs to develop facilitation skills to be successful online; and provide access to extended online resources. Similar competencies are mentioned by Salmon (2003). Teaching online involves having an understanding of online processes and technologies to be able to design and organize the activities. Teacher should have online communication skills and be able to diagnose and solve problems and opportunities online, be able to use emotions and solve conflicts constructively; The online teacher should have content expertise and knowledge about valuable resources, give creative feedback and build on participants' ideas; and show a positive attitude, commitment and enthusiasm for online learning.

(Anderson et al., 2001)	(Goodyear et al., 2001)	(Harasim et al., 1997)	(Mason, 2001)	(Salmon, 2003)
Instructional design and organization is concerned with thinking through the process, structure, evaluation and interaction components of the course	Designer is concerned with designing worthwhile online learning tasks	Set the stage	Appropriate setting	Understanding of online processes and technologies to be able to design and organize the activities
	Manager-administrator is concerned with issues of learner registration, security, record keeping, and so on	Forming groups and assigning responsibilities	Structured course design	
	Assessor is concerned with providing grades, feedback, and validation of learners' work	Establish norms and grade performance		
Facilitating discourse is critical to maintaining the interest, motivation and engagement of students in active learning	Process facilitator is concerned with facilitating the range of online activities that are supportive of student learning	Monitor and encourage participation	Online facilitation skills	Online communication skills and be able to diagnose and solve problems and opportunities online
	Advisor-counselor works with learners on an individual or private basis, offering advice or	Moderate and facilitate group processes		Use emotions and solve conflicts constructively

	Counseling to help them get the most out of their engagement in a course			
	Technologist is concerned with making or helping make technological choices that improve the environment available to learners			
Direct instruction is concerned with providing intellectual and scholarly leadership and share their subject matter knowledge with students.	Content facilitator is concerned directly with facilitating the learners' growing understanding of course content		Provide content and access to online resources	Content expertise and knowledge about valuable resources, give creative feedback and build on participants' ideas
	Researcher is concerned with engagement in production of new knowledge or relevance to the content areas being taught			Positive attitude, commitment and enthusiasm for online learning

Table 2: Summary of online teaching roles and competencies

2.2 Research in online teaching

In general there seems to be consensus about the online teachers' role and competencies in the literature. It is therefore interesting to discuss some recent studies in networked learning that focus on the role of the teacher.

With respect to the teachers' overall presence during networked learning activities, recent studies report that students perceive the communication with the teacher as constructive and encouraging, and they like the tutor to be involved throughout the course and not just in the beginning (Browne, 2003; Clouder & Deepwell, 2004; Vonderwell, 2003). Also Rimmershaw (1999) concludes that the teacher's active participation might have been critical in setting the right tone for the more successful courses and Rovai (2001) stresses that it is the teacher's challenge to create appropriate conditions by developing a sense of community in the group. According to Lim & Cheah (2003) there are a number of roles that teachers should play during asynchronous learning, these are; setting meaningful tasks, providing technical guidance, participating actively, keeping the discussion focused, drawing conclusions, providing content

expertise, and recommending resources for extension of learning. At the same time they argue that teachers need more specific guidelines on how to execute their roles in asynchronous discussion boards. Levy (2003) reports that at the early stages of the course there was a need for more intensive and direct personal contact between teachers and participants, in particular to monitor and support individual participants' awareness of specific features of the learning design and more general understanding of learning issues. Ferry, Kiggins, Hobam & Lockyer (2000) concluded that it is the task of the teacher to set the scene at the beginning of the course, and to keep the conference constructive throughout. Teachers constantly need to monitor the discussion and provide input at appropriate moments (Ferry et al., 2000). At the same time research points out that students started to develop leadership roles themselves within their group. These roles emerged from the strong feeling that a leader was needed to actively monitor and pull the reins from time to time, and to keep the discussion more focused (Light, Nesbitt, Light, & Burns, 2000; Strijbos et al., 2004). However most important is that the teacher needs to tune in during the collaboration process to find out what kind of moderation behaviour a specific group needs. "The social and pedagogical presence of the instructor is essential for improved communication and learning. Yet, online instructors need to be careful in structuring a feedback mechanism to encourage students inquiry and collaboration rather than quick, immediate answer to a question that can itself be a barrier for effective student learning." (Vonderwell, 2003, p. 88).

Research shows that teacher involvement and active participation is appreciated by the students. The students find communication with the teacher constructive and encouraging, and the teacher can support the students by setting the right tone for the discussion and contributing to develop a sense of community. With respect to the roles that teachers should play, the studies point out that students seem to need or appreciate active teacher pedagogical guidance in the beginning, which can gradually transform into a more facilitative role in the middle and end stage of the discussion. However a constant monitoring (even if only at a distance) by the teacher throughout is required to be able to tune in when needed. There is some evidence for students picking up some roles or leadership task to compensate for the 'lack' or absence of teachers input.

On the other hand moderators acts rely on their own experience with moderating online discussions. See for example a study conducted by De Laat, Lally, Lipponen & Simons (2006) in an asynchronous environment where it was found that a beginning teacher was very nervous and overwhelmed by the activities undertaken by the group, while the experienced teacher had developed a mental framework of how the course develops over time and knows which activities to expect by when.

3. THE USE OF KWIC AND KAIC TO SUPPORT MODERATION IN ARGUNAUT

The KWIC and KAIC method of analysis applied to electronically mediated communication is essentially an interpretative method supported by the use of electronic text-analysis using concordance software. In the KWIC method the use of KWIC – abstracted lists of Key Words in Context - replaces the role often played by coding in discourse analysis allowing for a more rapid hypothesis forming, testing and refining cycle. This has proved to be a powerful method for comparing texts, including pre and post-texts taken before and after an intervention improving the quality of dialogue in order to assess the efficacy of that intervention. KAIC, the idea of performing a similar analysis on Key Actions in Context has not been used before but was introduced to apply the same principles as KWIC to the case of Digalo where choosing the shape of a text box and the colour of an arrow as well as the position of an arrow are actions that enter into the dialogue and so need to be included in the

analysis. It was thought that patterns formed by boxes and links might be accessible to analysis in a similar way to patterns of words using KWIC.)

The KWIC method of analysis does not rely on a glossary of words in advance but allows 'key' words to emerge in context. However in general it is hard to link claims and reasons in English without choosing from a limited set of logical connectors such as 'because', 'if', 'therefore', and, more ambiguously, 'so'. Requests for explanations normally use 'wh' question forms: 'why?'; 'where?'; 'when?'; 'what?'; 'how?'. Reasoned challenges tend to include terms such as 'but', 'however', 'I disagree' and so on. Therefore it is quite conceivable for text based dialogue to prepare a glossary in advance of terms likely to be indicative of the quality and quantity of critical discussion and reasoning. Unfortunately this does not appear to apply to Digalo. In the existing data which we have analysed there is no evident emergence of a set of key words that would be used as a measure of the quality of the dialogue. It is possible that indicators of critical reasoning, like 'because', 'if', 'but', 'however', etc. might not occur frequently in the Digalo discussions because the use of agreed contribution shapes replace the need to use these indicators. Empirical work with native English speakers will prove essential to determining if the KWIC method is relevant for the analysis of Digalo maps. We would certainly recommend building in a concordancing capacity into awareness tools and including a representations of Key Actions (defined above) in this so that Key Actions can be included in any search for communicative patterns.

To explore the factors (possibly visible as to features of maps) that stimulate reflection and critical reasoning and other thinking skills embedded in dialogues, we will rely on empirical work including the use of video data and stimulated/ critical event recall. The method begins with detailed interpretation of communicative events in which something valued is seen in order to abstract generalisable features such as key words or actions that contribute to the event. We are confident that these factors will correlate with features accessible to data-mining whether at the level of KWIC or KAIC or in some other form

Alternative suggestions for using KWIC and KAIC are:

- Pattern recognition, to see if contributions have a similar content. With the use of KWIC, contributions with similar content can be identified and make the (sub)group aware of potential links in the current map or show the group/moderator potential overlap in the discussions between various contributions. In some of the data for example we saw a lot of repetition in the notes contributed by different students.
- Use of key words and its relationship with the chosen ontology. In the question shape in Digalo, one might expect to find words like, 'how', 'why', 'what', etc. or the use of questions marks. Questions asked in other shapes could easily be identified.
- Allow the moderators to generate their own KWIC glossary for each learning task. This way they can quickly find out if certain expected topics are being discussed by the students and when they were introduced. Using KWIC analysis, the system can alarm the moderator about the absence (or over-presence) of these expected key words in the map.
- The use of KWIC to help students find new material directly related to the content of their contributions. Semantic Googling allows users to enrich their conversation based on contextual relationship between discussed topics and related websites discovered by Google. KWIC can be used in this way as well.
- Use KWIC to identify new content added to the discussion. The addition of new key words to the discussion could indicate that the discussion is moving in a new direction. This can make the moderator/ students aware of new elements added to the discussion and analyse / discuss its relevance.

- KWIC can be used to colour code messages with a similar content, highlighting the identified key words. This way the group can be presented with a quick overview of the arguments made so far and reorganize the map accordingly.
- Use KWIC to produce an automatic coding of communicative moves such as asking questions or challenging a claim.

4. INDICATORS FOR DIGALO

Based on the previous sections we provisionally propose a set of features made up of 'indicators', including dimensions which could be used to assess the quality of dialogues and interventions in Digalo in relation to the aim of teaching general thinking skills, specifically reflection, critical thinking and creativity. These features of Digalo maps are derived from theory as worthy of further investigation. Only empirical study will show if they are in fact useful.. Deliverably D6.1 of work package 6 will provide a detailed description of how these indicators will be tested during the experimentation phase of the ARGUNAUT project. In the table below, where the indicators are listed, we provide a description of the indicators, how they are implemented in Digalo, in what way the group (teacher / student) can be made aware and what kind of action can be taken based on the previously discussed online teacher roles and competencies.

Indicator	Description	Implementation	Awareness	Action
Synthesis	Summing up a strand of discussion	Hand coding		
Metacognition / reflection	Questioning or commenting on the process of thinking and/or assumptions of the discussion	Hand coding		
Empathy	Taking the perspective of the other in the debate of the scenario	Hand coding		
Explicit reasoning	Appropriate use of argumentation	Hand coding		
Creativity	Appropriate use of original analogy	Hand coding		
Intertextuality	Relevant material from outside the exercise	Hand coding		
Dialogic engagement	Inclusion of themes and content from previous utterances	KWIC?		
Fallacy	Violation of ground rules given by Van Eermeren in the context of critical thinking	Hand coding		Question student

Copy and paste	Different contributions with the same content	KWIC to identify contributions (or sections) with 100% similar content	Colouring (= highlighting contributions in the Digalo map) differentiating original and copied material	Content facilitation Direct instruction (re-iterating ground rules for engaging in critical and reflective dialogues)
Similarities	Different contributions with similar content	KWIC to identify contributions with similar content based on key words	Colouring	Content facilitation (show potential links in the current map)
Initiating new topics	The introduction of anticipated new key words in the discussion by the group members	KWIC identifying pre-defined keywords entered by the teacher before using Digalo	Colouring Generating a graph showing time (x-axis), user (y-axis) and keyword (intersection)	Content facilitation Process facilitation: monitor and encourage participation
Emerging keywords	The introduction of unanticipated new key words in the discussion by the group members	KWIC identifying the rising of new frequently used (key)words by the group members	Colouring Generating a graph showing time (x-axis), user (y-axis) and keyword (intersection) Generating a tree graph showing the key word chain	Content facilitation Process facilitation: monitor and encourage participation
Flow of keywords	Follow the uptake of keywords used in the discussion by the group members	KWIC identifying the uptake of keywords by the participants	Generating a timeline graph showing time (x-axis), user (y-axis) and keyword (intersection) Generating a tree graph showing the key word chain	Content facilitation Process facilitation: monitor and encourage participation
Clustering of keywords	Group of contributions using particular keywords 'isolated' from the rest of the discussion	KWIC identifying the uptake of keywords by the participants	Colouring	Content facilitation

	elsewhere in the map			
Use of question shape	Using the appropriate shape as defined in Digalo	KAIC to identify relationship between question shape and its content, using keywords like; ‘?’, ‘why’, ‘how’, or sentences starting with a verb.	Colouring question shapes without the expected keywords and colour other shapes in which question-type keywords appear	Content facilitation Direct instruction (re-iterating ground rules for engaging in critical and reflective dialogues)
Change of shape	Changing the shape after it was posted	KAIC to track when shapes are edited	Colouring	Content facilitation (could be a sign of reflection)
Use of opposition link	Using the appropriate link as defined in Digalo	KAIC to identify relationship between link made and its content, using keywords like ‘but’, ‘however’, ‘disagree’, etc.	Colouring	Content facilitation Direct instruction (re-iterating ground rules for engaging in critical and reflective dialogues)
Disagreeing	Use of oppose links	KAIC to identify if there are too many.	Colouring	Content facilitation (the discussion might be unbalanced) Process facilitation (the group might follow a (un)popular person)
Use of support link	Using the appropriate link as defined in Digalo	KAIC to identify relationship between link made and its content, using keywords like ‘I agree’, ‘good point’, etc.	Colouring	Content facilitation Direct instruction (re-iterating ground rules for engaging in critical and reflective dialogues)
Agreeing	Use of support links	KAIC to identify if there are too many.	Colouring	Content facilitation (the discussion might be unbalanced) Process

				facilitation (the group might follow a popular person)
Gravitation	Dominance of contributions being linked to one central contribution	KAIC to identify popular / central contributions (star shape networks)	Colouring	Content facilitation Process facilitation (regroup, encourage participation, etc)
Unlinked shapes	Besides new threads, nothing in a map should appear unlinked	KAIC to identify isolated shapes	Colouring	Content facilitation Direct instruction (re-iterating ground rules for engaging in critical and reflective dialogues)
Creation of links	Making a link between previously posted contributions	KAIC to track when links are established, by whom and to whom	Colouring, differentiating between links to oneself or to another	Content facilitation (could be a sign of reflection)
Change of links	Changing the link after it was posted	KAIC to track when links are edited	Colouring	Content facilitation (could be a sign of reflection)
Rearranging	Reorganising the Digalo map	Keep track of (re)positioning of the contributions	Generate before - (during) - after Bitmaps	Content facilitation (could be a sign of reflection) Process facilitation (regrouping contributions into subgroups)
Semantic Googling	Using search engines to find additional content	Use KWIC for semantic Googling to allow users to enrich their conversation based on contextual relationship between discussed topics and related	Define a special shape for this in Digalo	Content facilitation

		websites discovered by Google		
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Table 3: List of indicators based on Work Package 5

5. METHODOLOGY ON HOW TO EVALUATE ONLINE DISCUSSIONS

Studying how participants engage in online discussions requires more than the analysis of a dialogue alone. In the context of Digalo for example the map, which reflects the outcomes of the discussion, presents a good first impression about the nature of the discussion but leaves question as, what is the quality of the learning process, levels of engagement, quality of the interactions between participants and their intentions and feelings about the map unanswered. In order to develop a richer description of the teaching and learning processes that take place when working with Digalo we propose the use of a multi-method approach to analyse from multiple perspectives the ways in which teachers and students are engaging in critical and reflective e-discussions and to describe how a moderator, and/or the group itself, moderates behaviour based on this engagement.

In a previous research project (De Laat, 2006) we have developed a multi-method research framework (see figure 2) to study teaching and learning processes in a networked environment. This method is a combination of social network analysis, content analysis and critical event recall.



Figure 2. Multi-method research framework for studying networked learning

The main aim of this approach is to describe how teachers and learners are engaged with networked learning activities using several perspectives or dimensions to triangulate our data and enriching our understanding of the processes involved and how they evolve over time.

Key elements are to understand:

- Who is talking to whom?
- What are they talking about?

- Why are they talking as they do?

The first question relates to the dynamics of the interactions between the participants involved. A suggested method can be social network analysis to identify group patterns and properties. Content analysis of the discourse amongst the participants is a way to address the second question. While critical event recall interview and the use of observations and thinking loud techniques are useful methods to gather contextual data about the participants and gain understanding about their strategies, experiences, means and ways of engaging in these discussions.

Previously research into networked learning was focused on directly observable but more superficial aspects of online communication and interaction; like number of messages exchanged (Harasim, 1993), length or word number of the messages, number and depth of the discussion threads (Hewitt, 1996). These studies however did not reveal much about the engagement of the participants with their collaborative learning tasks. Richer analysis on how and why people are learning collaboratively online became the focus research.

A second development was the use of coding schemes to conduct discourse or content analysis (like, Gunawardena et al., 1997; Henri, 1992; Newman, Johnson, Webb & Cochrane, 1999) to try to pattern out some of the learning activities participants were engaged in. Coding of the content shared between the participants seemed the first logical choice for investigation. However, coding learning activities alone does not provide enough insight into the collaborative processes. Through reading these messages it became clear that besides the teacher, the students are also actively engaged in managing the group processes and their learning agenda (De Laat & Lally, 2003). The learners are taking active control over the organisation of their learning processes and come to act as both learners and teachers. Managing and regulating group processes can be seen as an act of meta-cognition, but the extent to which participants were engaged exceeded the way we commonly think about meta-cognitive knowledge; i.e. as a way to reflect on one's own learning strategies (Flavell, 1979; Schraw, 1998). Feeling responsible for group learning and actively managing and regulating group processes and commitment seemed something that needed more attention in current research. De Laat and Lally tried to highlight this distinction by coding both learning and tutoring activities. They have interpreted peer tutoring as an act of meta-cognitive knowledge and skills, in the sphere of (developing) an awareness of other people's learning styles and strategies, and the capacity to use this knowledge to reflect on one's personal and other participants' learning. This is helpful in order to coordinate and regulate the collaborative learning activities. As such a distinction was made between intra- and inter meta-cognitive (or social meta-cognition) knowledge. Together with the coding scheme developed by Veldhuis-Diermandse (2002) to code for 'on the task' learning activities, they used the coding scheme developed by Anderson, Rourke, Garrison & Archer (2001) to highlight the tutoring activities conducted by the participants 'around the task'.

Coding provides data on '*what the participants are talking about*' but it does not indicate clearly to what extent the members are participating in the collaborative learning task. In an attempt to further develop a method for describing networked learning processes, De Laat et al. (2006) used social network analysis as an additional method to describe the connectivity, group cohesion and interaction patterns of this networked learning community ('*who is talking to whom*'). Together with the coding results we could now also study the extent to which active participants were engaged in learning and teaching activities, and see if these activities were conducted by a few core members, constantly talking to each other, or if they were nicely spread over the entire group.

Both these methods (content analysis and social network analysis) produced behavioural patterns and how they change over time, but as such did not provide an explanation for why the participants were acting this way. To explore '*why they are talking as they do*', De Laat, et

al. (2006) applied contextual analysis as a way to include participant experiences with networked learning. they used critical event recall interviews as well as student peer assessment reports to conduct these analyses (see appendix A for more information about the critical even recall method). The outcomes of content analysis and social network analysis were used in two ways. Firstly, as a way to select the participants for the contextual analysis. This way they tried to cover some interesting emerging patterns, like dynamics of central-versus peripheral-acting participants, and participants who showed increasing versus decreasing activity over time. Secondly, they used the coding results, for example as a stimulus during the critical event recall interviews, and asked the participants to reflect on these patterns as a way to focus the interview.

The critical event recall interviews with the students will be based on the event that took place during their learning task. The teacher, who in most cases will be seen as the main moderator of the discussions, has a special role in this context, because of its overall responsibility of the quality of the learning process. We have therefore prepared a short questionnaire about moderation for the teacher to be filled out in advance (see appendix B). Also we would like the teacher to keep a teaching diary to document teaching strategies and activities of the teacher during this task.

The need for a richer more holistic approach to researching networked learning has been acknowledged by other researchers in the field and one can say that in retrospect another trend is emerging. This third and emerging trend argues for a multi-method or multi-dimensional approach to analyse teaching and learning in networked learning environments (De Laat, et al. 2006; Hakkinen, Jarvela & Makitalo, 2003; Lockhorst, 2004; Ravenscroft, 2003; Strijbos & Stahl, 2005; Weinberger & Fischer, in press).

One aspect, however, that is not systematically addressed in networked learning research designs is the dimension of time. Research is often based on a summation of codes or an overall impression of networked learning processes over the entire course. Yet we like to think that group processes are dynamic and evolve over time. If we present general overviews, we are in danger of losing (or ignoring) detailed information of what learning and teaching processes actually took place during the event, and what capability the group has developed to learn collaboratively. Especially when conducting educational research where the interest is in studying how people learn, a timeline approach could prove very useful (De Laat, 2006). Learning is typically a process of gradual changes in performance and understanding. Understanding learning means focusing on how these changes take place. The aim of the timeline analysis is to 1) track how learning, teaching, peer tutoring/ moderating strategies are being developed and used in the group, 2) identify phases in the problem solving process and analyse if each phase has its own teaching and learning behaviour, 3) track individual participation and growth in the ability to participate in the activities of the group.

As soon as certain key phases have been identified or a series of learning activities have been allocated, all the codes or observations made during content analysis for example can be time stamped accordingly. This way a detailed and deep analysis of the critical and reflective discussions can be made in Digalo based on which specific support and awareness tools can be developed to scaffold a particular phase in the learning and teaching process.

In sum there are some reasons for including timeline analysis in research designs for networked learning (De Laat, 2006):

- Critical and reflective discussions develop over time. Understanding how they develop requires a process approach
- Groups go through several stages of development and develop a way of working together.
- Learning-tasks require a variety of strategies depending on group progression to solve the problem at hand. A time line approach allows you to connect with the phases of the problem solving cycle developed by the group to complete their learning task.

Our overall aim in this analysis will be to uncover the incidents that stimulate reflection and critical reasoning in the groups and individuals and to find those features of the ‘maps’ accessible to data-mining and automatic awareness that correlate with these incidents. Whatever it is that encourages learning and thinking within the activities will correlate with patterns of data, whether at the level of KWIC or KAIC or perhaps in some other form. However without the full analysis it is difficult to say what these patterns are. The methodology presented here will serve as a general guide to inform the experiments studying how the participants are engaged in online learning and moderation. The way this multi-method approach will be applied is dependent on various factors and can change from one setting to another and are influenced by the nature research questions. In D6.1 of work package 6 a detailed account of what will be the research focus and setting during various planned experiments (aimed at describing and testing the ARGUNAUT system) will be presented.

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APPENDIX A. CRITICAL EVENT RECALL

This method is a form of ‘stimulated’ event recall (Interpersonal Process Recall - IPR). IPR is a process developed by Norman Kagan, commencing at Michigan State University (Kagan & Kagan, 1991). A broader theoretical and practical overview has been provided by Tuckwell (1980). The basis of IPR, as it was developed by Kagan and others, is the realisation that humans store vast amounts of information, feeling, impressions and ideas about the events, or ‘interpersonal processes’, in which they have participated. Because of the speed at which human interactions occur much of the detail of these processes is soon ‘forgotten’, and not available for subsequent reflection. IPR has been used in educational research to help schoolteachers to analyse the teaching and learning processes occurring among the pupils in their classrooms (Lally & Scaife, 1995). When groups of participants engage in mutual or shared recall of events in which they have been present together they can gain insight into their behaviour and learning processes. In a sensitively guided recall this can be of benefit for the future learning of the group, as well as the individuals within it. The recall enables the articulation of many previously unexpressed aspects of learning.

Critical event recall was used extensively to study networked learning environments (see De Laat, 2006), where students and tutors are working in learning communities with many complex learning interactions occurring simultaneously. The use of the records of these interactions as a stimulus to recall of critical learning events occurring during the programme workshops suggests itself as a way of investigating those aspects of these processes not actively expressed during the events. We have termed this critical event recall, and adopted two approaches to undertaking it. In the first approach the participant is presented with summary analyses of the group and individual learning events, based on the outcomes of our content analysis. These give an overview of the patterns of learning and tutoring within the event. In the second approach we use the full text of learning events. In both approaches the participant was presented with these items in advance of the recall sessions so that they might familiarise themselves with the summary analyses and full text of the events.

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APPENDIX B. INSTRUMENT FOR GATHERING CONTEXTUAL DATA ABOUT MODERATION

General rules for teaching could be problematic, teachers adopt different pedagogical approaches, make different use of Digalo in their classes (for example blended / remote; individuals / subgroup) and different tasks / subjects might result in different types of dialogues in Digalo. It might be more useful to ask the teachers more specifically what they are doing and why they adopted a particular approach, instead of providing pre-scriptive rules on how to use Digalo.

First will be a general questionnaire, based on the questions provided by Claus. Followed by a teacher diary. This is a diary on his/her experiences while moderating this learning task.

We will need to think about an appropriate format for collecting this information. It would be nice if we can implement this questionnaire and diary in Digalo to keep all the data together with the maps they are working on.

1 questionnaire

General questions on moderating:

- Can you describe your role as moderator in Digalo?
- What do you do when you are moderating discussions in Digalo?
- When do you decide to moderate during a Digalo discussion?
Please give multiple examples of different key moments
- What, in your opinion, are good moderating interventions in Digalo?
- What, in your opinion, are bad moderating interventions in Digalo?

Could you react to the following statements:

- Good discussions do not (necessarily) require a moderator. Discuss!
- Good moderators intervene as soon as possible to get discussants back on track. Discuss!
- Good moderators are those with a laid-back attitude. They only intervene as a last resort. Discuss!
- A discussion can be judged entirely by its outcome. Discuss!
- The process of discussing is more important than the outcome of the discussion. Discuss!
- Good moderators attempt to include those which haven't contributed to the discussion so far. Discuss!

- Good moderators attempt to give the floor to those which can make good contributions. Discuss!
- Good moderators attempt to give the floor to those which haven't made contributions so far!

2 Teacher diary using Digalo.

Start a teaching diary to record the daily teaching, moderating and learning experiences during this task.

A) General information about the learning task. Most of this information is probably already recorded somewhere else and can be copied into this diary.

- describe what the task is about
- describe aims and objectives of the task
- describe how Digalo is part of this task
- describe who is involved
 - what are their roles and tasks
- describe your own role and participation during this task
- describe the pedagogical approach used during this task
 - explain what is done during the task according to this method
 - by the teacher/moderator
 - by the students
- describe the instructions given to the students
 - instructions on how to use Digalo during this task
 - instructions on what to do and when (dealing with task content)
 - instruction on how to do it and when(dealing with group processes)

B) Daily descriptions of activities during the learning task

- Provide date and time indicators.
 - Describe what you and the students were doing and how this relates to the overall progress made on the task.
 - Describe key teaching and learning events during 'today's' activities, and when appropriate, provide the numbers of the corresponding Digalo contributions.
 - Describe how and why you decided to moderate (or deliberately decided not to moderate) based on these key events (provide corresponding numbers of contributions made in Digalo).
 - Do you see evidence of students moderating each other during the task?
If so, describe what the students are doing (provide corresponding numbers of contributions made in Digalo).
 - If so, what did you do or not do because of it (provide corresponding numbers of contributions made in Digalo)?