DIALECTIC: Enhancing essay writing skills with computer-supported formulation of argumentation

Evi Chryssafidou

Kodak/Royal Academy Educational Technology Group
School of Elec. & Elec. Engineering
The University of Birmingham
E.Chryssafidou@bham.ac.uk

Abstract. Writing an argumentative text is a difficult task. The difficulty often lies in relating ideas inside a text, namely assigning supporting arguments to one's position or refuting counterarguments. School education on argumentation skills focuses on identifying argument components and argumentative schemes, which is essential for writing essays but not all that is essential. Similarly, existing systems, which support the formulation of arguments or teach argumentation skills, employ argumentative scheme patterns and request from the users to develop arguments by filling in these patterns.

This paper proposes Dialectic, a computer-supported environment, in which the student is introduced to the process of defending a position by supporting and refuting positions and arguments. Instead of analysing in detail the particular features of an argument, Dialectic teaches argumentation as the process of resolving a difference of opinion by supporting it with arguments, by anticipating counterarguments and by consequently refuting them.

The system will provide support in three ways: (i) by using diagrams in the process of formulating arguments; (ii) by allowing the user to interact with a "coach" who gives advice on the structure of arguments; (iii) by encouraging the student to exchange comments with a collaborating human tutor in the intermediate stages of writing up an essay.

1. INTRODUCTION

Writing an argumentative text is a difficult task. Previous studies which investigated the argumentative skills of secondary schools students ascribe the difficulties to lack of specific education, which would help students to disentangle the complexity of argumentation (van Eemeren, Grootendorst and Hankemans, 1996).

Formal education does not offer the student the opportunities to develop experience in defending a position (Oostdam and Emmelot, 1991; Oostdam, de Glopper, Eiting, 1994). The assumption in school is that if the students are familiar with argumentation schemes, they could reproduce them when writing an argumentative text. Research findings indicate that although students can invent arguments or even identify them among resources, they are not as good in "synthesising" them into a coherent text (Oostdam, de Glopper, Eiting, 1994).

It has been reported that students failed to state their standpoint in the beginning of the text, i.e. their stance towards the debate, although they have been asked to support their own opinion. Students do not understand or choose to ignore what is the task that is being requested of them (Oostdam, de Glopper, Eiting, 1994). They choose a statement with which they agree or disagree and comment why they do, even though this is not the task requested (Ryan & Norris, 1991). It is often seen that students develop arguments separately and omit to

relate each argument to a high-level structure or one standpoint (Keith, Weiner & Lesgold, 1991). Problems with refutation have also been reported. In most cases, students take up an argument against the formulated standpoint and then they reject it without justification.

In order to help students to overcome these problems this paper proposes the design of a system, which aims
-to help choose a standpoint when developing arguments,
-to assist students to formulate well-structured arguments,
-to guide the students through the stages of planning and writing up an essay,
-to facilitate the process of writing up an argumentative essay in the context of an on-line tutorial with the a human tutor and,
-to allow formative and collaborative evaluation of arguments and essay drafts by the student and the human tutor, as opposed to summative evaluation on the final product by the tutor.

The following section briefly overviews the predominant formalisms of representing arguments as well as computer systems, which support the formulation of argumentation.

2. ARGUMENTATION FORMALISMS IMPLEMENTED IN COMPUTER SYSTEMS

An *argumentation formalism* consists of a set of primitive elements as well as connectors for linking the elements, out of which argument representations can be constructed. These elements are called "claim", "data", "warrant", "backing", "rebuttal", as in Toulmin's model (Toulmin, Rieke & Janik, 1979) or "issue", "position", and "argument" as in Rittel's work (1970). There are a number of research efforts related to argument formulation software tools which implement the Toulmin and IBIS argumentation formalisms[1]. Their purpose is to identify the expressed or unexpressed premises, which establish the relationship between a claim and its supporting evidence (Toulmin's model), and break a position down to issues, sub-issues and positions (IBIS).

Toulmin's model is the first significant attempt of argumentation analysis. An advantage of this model is that it directs the arguer to determine important parts of an argument and to state inferences and principles, which are otherwise implied or omitted (Gasper & George, 1998). This process may lead to deeper analysis of the argument and thus better understanding of argumentation (Hair and Lewis, 1991).

However, Toulmin's representation illustrates elements that are relevant to an individual argument. It cannot cover the overall structure of an argumentative text. Problems with Toulmin's notation have been reported in connecting different parts of a large argument into a unified structure (Hair & Lewis, 1991; Gasper & George, 1998; Henkenmans, 1992). This problem is enhanced by the fact that Toulmin's model does not allow the arguer to represent comparatively the elements of two opposing arguments, or to illustrate possible interrelations between arguments with common or contradictory conclusion[2]. Additionally, there is a risk to erroneously assume that arguments consist of only one datum and one warrant (Gasper &

[1] For an overview of implemented argumentation schemes see Shum and Hammond, 1994

[2] A good illustration of the misuses of Toulmin's model can be found in the work of Gasper and George (1998), who have studied the use of Toulmin format in enviromantal planning and public argumentation, and have gathered examples of published work by academics in policy analysis.

George, 1998), given the diagram examples of Toulmin's model found in several books and articles (Warnick & Inch, 1994; Henkenmans, 1992; Govier, 1988).

While Toulmin's approach to argumentation is strictly structural, i.e. the validity of argument depends on the form of arguments, the Issue-Based Information System (IBIS) (Rittel & Kunz, 1970) does not content any rules or constraints related to the validity of positions towards an issue. Rittel's work on IBIS supports the process of structuring design problems, making known the available options and solutions and recording design decisions during the actual design for future reference.

The main weakness of these argumentation formalisms is the focus on details of argument components at the expense of larger goals, such as the overall structure of an argumentative text. Another limitation lies in the reconstructing strategy that these formalisms suggest when an argument or an argument component is criticised. In case of doubt or criticism, the formalisms help to invent another, potentially better, argument, and not to explicitly refute the one in doubt.

The predominant hypothesis behind the computer systems based on these formalism is that employing diagrams could help users to construct more rigorous, easier to communicate arguments by making the structure of arguments explicit (Coirier, 1996; Larkin & Simon, 1987; Scaife & Rogers, 1996). In these terms, it is claimed that the syntactic (not the semantic) structure of diagrammed arguments, which is not concerned with the meaning or the truth of the content could help arguers to formulate their statements. The above argumentation formalisms influenced most of the research on computer-supported argumentation (Shum and Hammond, 1994) and inherited their limitations.

A rough line could be drawn between those systems. On the one side are found the systems that simply provide a drawing tool for diagramming basic constructs (MacEuclid[3], QuestMap[4], AAA-Schuler and Smith, 1990). On the other side are those which incorporate characteristics of Artificial Intelligence (Euclid-Smolensky et al, 1987) or Intelligent Tutoring Systems (ITS) (SEPIA-Streitz et al., 1989; Belvedere- Suthers, 1998).

The system proposed in this paper, Dialectic, belongs to the category of ITS. It incorporates an expert "coach" that monitors the structure of arguments and provides feedback according to the underlying heuristics of what a complete argument should be. The user manages argumentative operations by establishing evidential relations between the diagram text boxes, while the "coach" provides feedback on the structure of the diagram.

In the category of ITS, Belvedere (Suthers, 1998) is the only system supporting argumentation which is fully implemented, thus possible to evaluate. Its purpose is to establish a shared workplace where peers engage in problem solving and collaborative scientific inquiry by drawing argument diagrams. In scientific inquiry emphasis is given on the distinction concerning the epistemological source of statements: empirical ("data") versus hypothetical

[3] MacEuclid has been created in 1992 by Bernard Bernstein in the University of Colorado http://www.tibis.com/tb-issues/TidBITS-153.html#Ink6 and ftp://ftp.cs.colorado.edu/pub/cs/misc/euclid

[4] QuestMap™ can be found at http://www.softbicycle.com/QMdownload1677.html

("hypothesis") (Suthers, 1999). In writing argumentative text, it is a requirement to know how to integrate these statements in the overall structure of the argumentative text. Belvedere was not designed to content this requirement. Here are the reasons why I believe that this system lacks some of the function which would support the process of argumentative writing. The system design of Dialectic is taking into consideration these functions.

- *The student develops arguments without intending to express an opinion towards an issue*

The system does not encourage the student to take a position towards an issue and to further argue on the reasons of taking this stance.

- *The system does not support refutation explicitly.*

If the user needs to refute an argument for which doubts have been expressed, the arguer has to re-draw the argument and replace the statement in doubt with another one. An "against" relation cannot exist between data, which are linked to a claim. Thus, the process of a new datum refuting a previous one cannot be illustrated on the diagram..

- *Advice is not adaptive to student improvement or deterioration of reasoning skills.*

In the case of reconstructing an argument following the coach's suggestions, the consequent advice is not adapted to the performed changes. The coach evaluates the structure of arguments in relations to the latest change only.

In the following section, the pragma dialectical approach to argumentation, on which Dialectic is based, will be presented. It will be argued that this approach eliminates the weaknesses of argumentation formalism mentioned above and overcomes the limitations of Belvedere in supporting argumentative writing.

3. THE PRAGMA-DIALECTIC APPROACH TO COMPUTATIONAL MODEL OF ARGUMENTATION

The pragma-dialectic approach (van Eemeren and Grootendorst, 1984, 1994) considers argumentation as the proceedings of a dialogue between two arguers, a protagonist and an antagonist. It is assumed that in an argumentative discussion two opposite claims are expressed, each by the protagonist and the antagonist respectively. These claims are called *standpoints,* while the statements with which the arguers defend or refute the standpoints are called *arguments*. The standpoint and the argument are the primitive elements of this argumentative approach.

Following this approach, written argumentative discourse arises in response to, or in anticipation of a difference of opinion. This difference is resolved when the opposing parties agree on the acceptability or the unacceptability of the disputed opinion. So, it is either the protagonist or the antagonist who wins. In written argumentative discourse it is assumed that the writer is the protagonist who anticipates the antagonist's critical and doubting existence.

The pragma-dialectic approach introduces the requirements that writers should meet in order to defend their standpoint. Here is a scenario based on the pragma-dialectic theory (van Eemeren et al.1996) concerning the argument moves one should undertake to defend or refute a standpoint. Notice that the arguer combines defensive and attacking moves in order to overcome the criticism.

Two opposite standpoints are put forward with respect to a controversial issue. Let us suppose that one decides to justify one of the two standpoints (*favourable standpoint*) and refute the opposite one (*disapproving standpoint*).

-A favourable standpoint is supported (fig.1) when an argument (A_1) in favour of this is expressed (defensive move (fig1-1)). If a counter argument (A_2) is expressed against the favouring argument (attacking move (fig1-2)) then this should be refuted (attacking move (fig 1-3)). If this counter argument (A_2) is not refuted and instead the supporting argument (A_1) is further supported then the argumentation is incomplete because the expressed doubt (A_2) is not rejected (fig1-4).

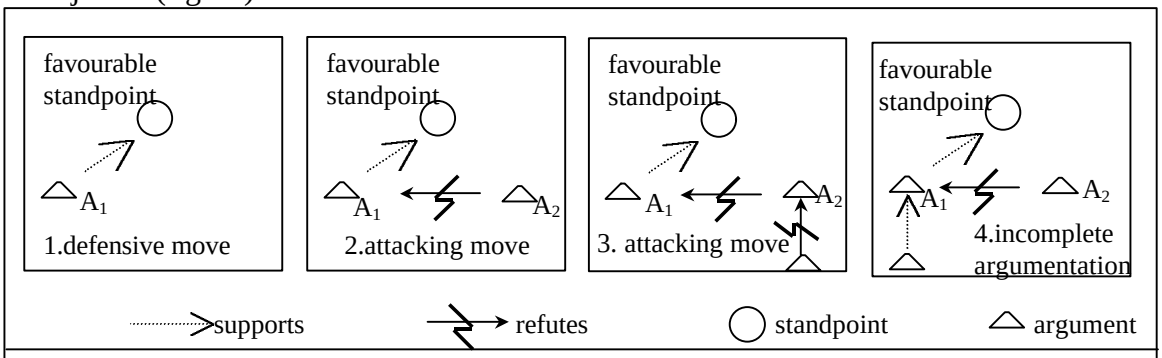


Figure 1: Stages towards supporting the favourable standpoint

-A disapproving standpoint (attacking move (fig.2-1)) is refuted if an argument against this standpoint is forwarded (B_1 in fig2-2). In the case where a disapproving standpoint is supported by an argument (B_2 in fig.2-3) then this argument should be refuted (B_3 in fig.2-3). If the disapproving standpoint is refuted by an argument (B_1 in fig.2-4) and it is also supported by another argument (B_2 in fig.2-4), which is not refuted, then this argumentation is incomplete.

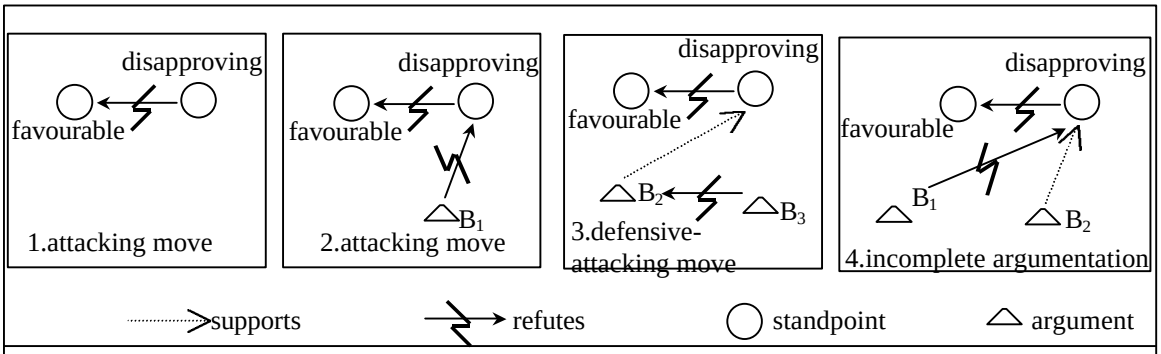


Figure 2: Stages towards refuting the disapproving standpoint

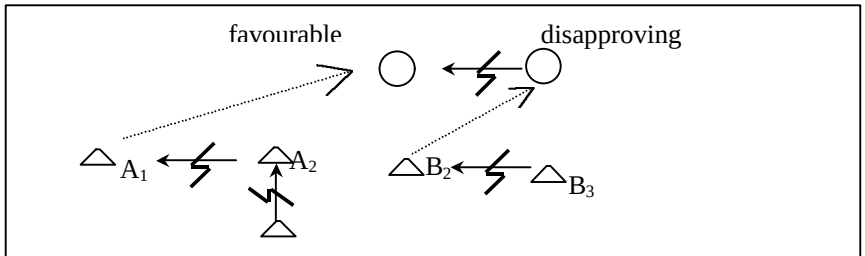


Figure 3: Argument structure when supporting the favourable and refuting the disapproving standpoint in an essay

When the structure of supporting and refuting a standpoint is integrated in one structure, then (fig.3) we can see the backbone of the argument structure of an argumentative essay. There are two opposing standpoints, and the writer has chosen to defend the favourable and there are arguments supporting or refuting each side.
Thus, in response to previous criticism (section 3), each argument has a purpose in relation to the overall structure of arguments.

Following the successive defensive and attacking moves (as in fig.3), it would be possible to see where is the non-refuted argument that weakens the defence of its related standpoint (for example in figure 3, if B3 was missing then B2 would threaten the defence of the favourable standpoint). However, in the case of an argumentative text or a real debate[5], the structure of arguments is far more complex than that illustrated in figure 3. More successive justifications and refutations take place. Dialectic represents diagrammatically this complex structure and its purpose is to assess where arguments weaken the support of the favourable standpoint and report it –if requested to the user. Thus, the diagrammatic representation of arguments will become a conceptual space, in which the users should attempt to find counterarguments or just stop as soon as their standpoint or arguments are well-supported.

The model of pragma-dialectic approach to argumentation suggests heuristic functions indicating what moves[6] should be undertaken in resolving a difference of opinion. These are central in the research that underpins the design of Dialectic. These heuristics are summarised in:

1. *"Combining defensive with attacking moves enhances the arguer's chances of defending his standpoint successfully",* (Henkemans, 1992:p133)

2. *"By showing that the other party's criticism regarding his argumentation is unjustified, the arguer has indeed successfully defended his standpoint. By refuting an argument for the opposite standpoint, he can only make his opponent withdraw this standpoint, which is of course, not sufficient to relieve him of the obligation to defend his own standpoint" (Henkemans, 1992:p132).* In other words, it is good practice to refute arguments that enhance the antagonist's position but it is even better if the arguer also considers the arguments threatening his/her own standpoint.

3. The arguer should attempt to find counter arguments and then try to refute them.

[5] For a diagrammed newspaper debate implemented on the proposed formalism see Appendix
[6] in fact these are speech acts (van Eemeren et al., 1996)

4. FRAMEWORK FOR THE SYSTEM DESIGN

The aim of Dialectic is to help students to formulate argumentation and include it in an argumentative essay. The system provides a platform, on which the formulation of arguments and the editing of an essay would become the object of an on-line asynchronous tutorial between a student and a tutor. As the basis for initial design, UML use case diagrams were employed. In the following figure (fig.4), UML diagramming notation (Larman, 1998) is used to assign responsibilities to system components.

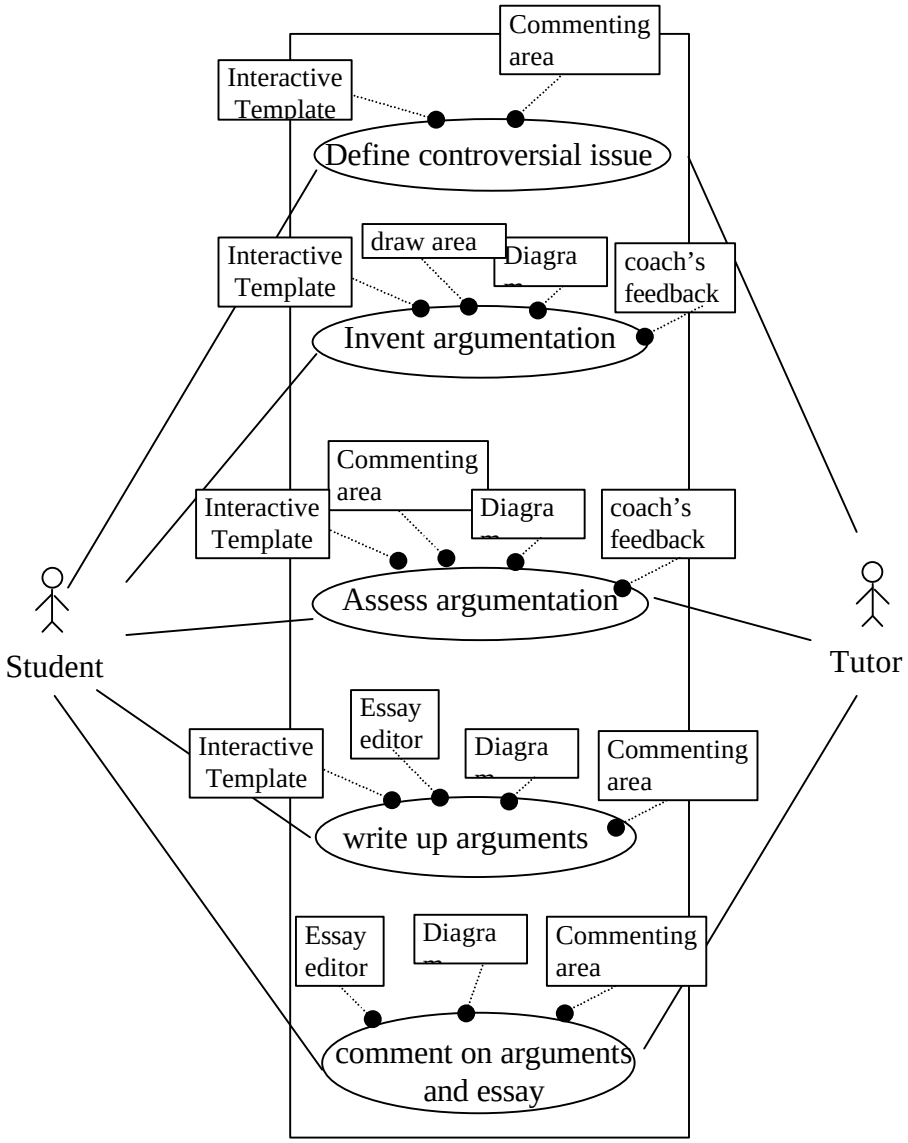


Figure 4: UML use case diagram of the system

In the beginning of the argument planning the student has to identify the controversy around which the debate is set. The student can consult the Interactive Template of Activity flow, (Fig. 5) for suggestions on how to define the topic. If there is still difficulty in this initial stage, the student can consult his tutor.

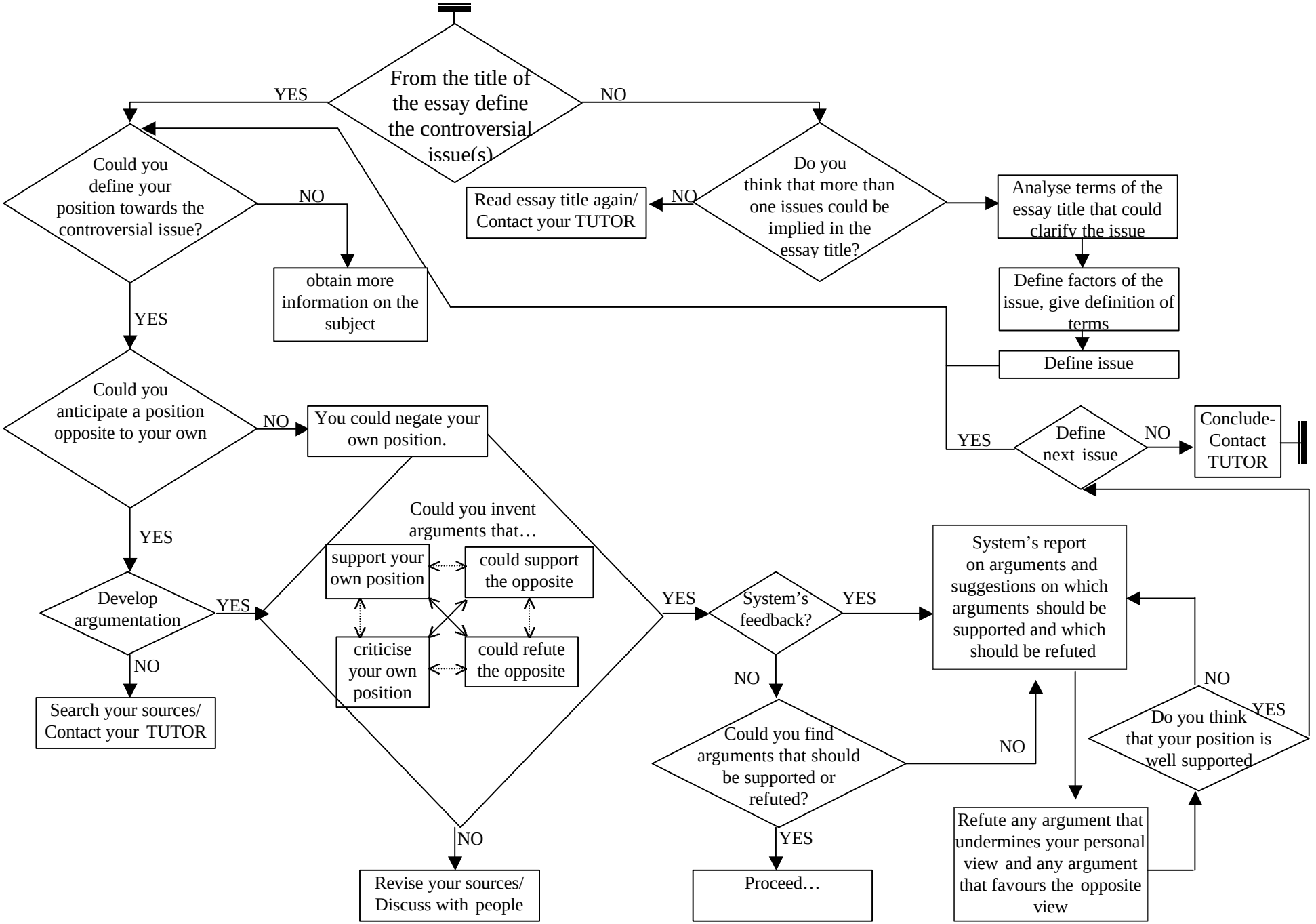


Figure 5 : Template of activity flow in using Dialectic

In the following stage (in the “invent argumentation” fig.4), the student has to defend his/her standpoint with arguments. In structuring the argumentation the student can receive help from the “coach” of the system. In order to design well -structured arguments the use of a diagrammatic tool is required. The student generates and arranges arguments on a diagrammatic representation, which consists of text boxes and graphic links. The “coach” observes the student’s attacking and defensive moves on the diagram and makes observations or gives advice only when asked. Its role is to help the student to anticipate criticism on every argument and to investigate the plausibility of arguments. The model underpinning the coach’s comments is based on the pragma-dialectic heuristics and validates the argumentation in terms of its diagrammatic structure.

After having drawn the arguments, the student assesses the structure and the content of the arguments in relation to the favouring standpoint. Before moving on to writing up the essay the student can discuss with the tutor the content of his argumentation or any problems that may have been raised during the previous stage.

When writing up the essay, the student has to decide on the rhetorical structure of the essay. Considering the diagram as analytic overview of the argumentative text the student would probably need to perform some necessary “presentation transformations” such as what can be left out, what should be added or what rearrangements should be implemented (van Eemeren and Grootendorst, 1994a). By presenting his/her draft as well as the diagram, the student can receive comments by the tutor before handing in the essay. The tutor highlights the structural deficiencies of the essay in relation to the diagrammatic structure.

Comments on drafts, as opposed to summative evaluation on final products, would allow the tutor to ask questions, suggest changes and assign new tasks (Horvath, 1985). and would give the student time to perform a few changes. Commenting on both the diagram and the text allows the tutor to evaluate the meaning and the purpose of early drafts and argument structure, leaving editing corrections for later (Sommers, 1982). Thus, emphasising on the argumentative operations while leaving the textualising operations for later alleviates the cognitive load imposed on the writer (Coirier 1996).

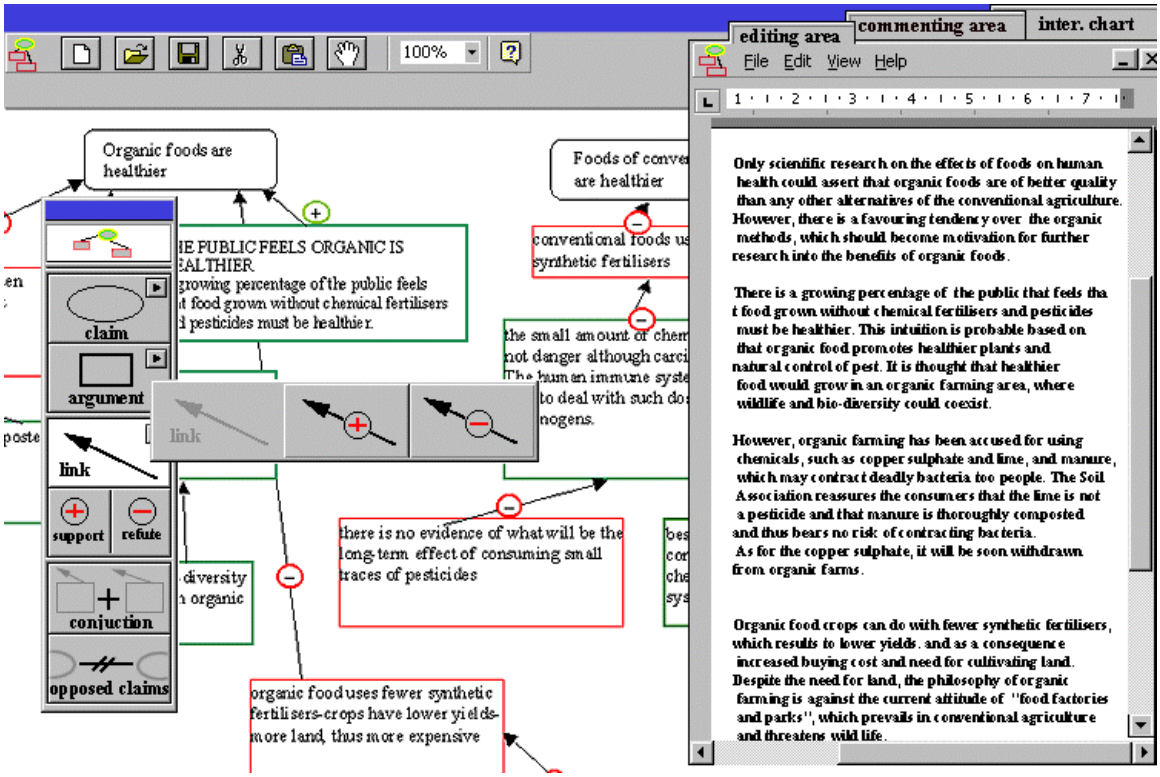


Figure 6: A screen shot of the prototype

5. COMPONENTS OF THE SYSTEM

An initial understanding of the system requirement points to the design of different system components:

Tools palette: This is the main feature of the drawing area where the user designs the argumentation using text boxes, graphic arrows and links.

Diagram: This is the artefact produced from the process of argument formulation using the tools palette. It is actually a file on which the Tutor and the Student could annotate their comments, establish hyperlinks with the essay, and mail it to each other in the context of the on-line tutorial.

Interactive Chart of the Activity flow: This is a flow chart where the user can find some of the possible steps he/she can take in order to formulate arguments and write up essays. For example, it is suggested how the user could start the argument development and when it would be useful to request the Systems or the Tutors advice (fig 5).

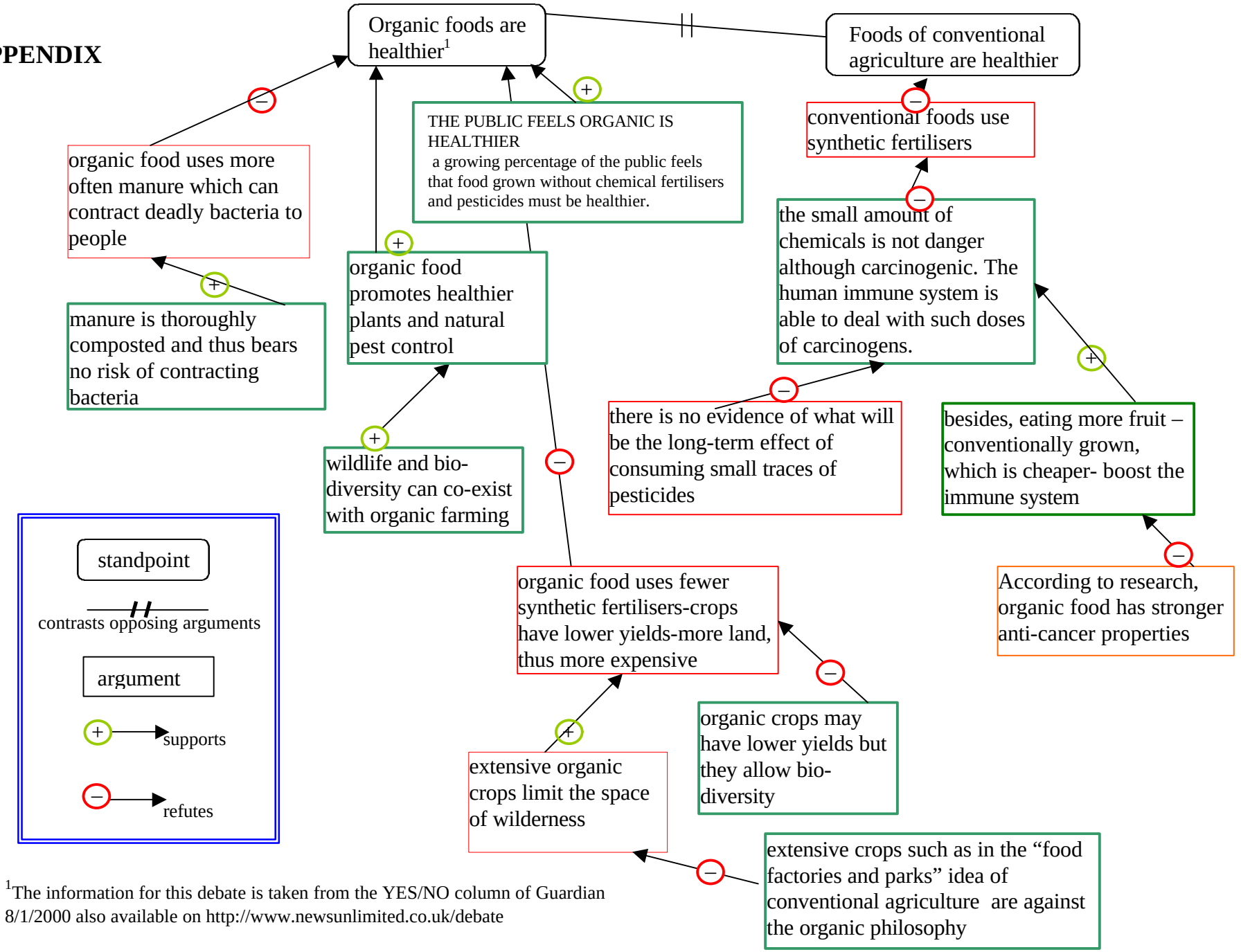
The system feedback: The system provides feedback on the structure of the arguments –not the content of them- only by request.

Communication and commenting area: This resembles an e-mail area where the Student and the Tutor could exchange their comments and observations about the structure and the content of the diagram and essay. It should be possible to assign hypertext links between the text of the commenting area and the relevant diagram or text segments.

6. CONCLUSION

The study presented in this paper is work in progress. Evaluating the use of Dialectic with student will hopefully give some evidence as to whether argument-formulating constraints embedded in the system could facilitate the formulation of argumentation and improve the quality of written argumentative texts. More insight should be gained, though, into the Student-Teacher interaction model. An experiment involving essay tutors and student is planned in order to study the Student-teacher interaction tutorial meetings.

APPENDIX



[1]The information for this debate is taken from the YES/NO column of Guardian 8/1/2000 also available on http://www.newsunlimited.co.uk/debate

REFERENCES

Coirier, P. (1996) Composing argumentative texts: Cognitive and/or textual complexity. In G. Rijlaarsdam, H. van den Bergh, M. Couzijn (Eds*.) Theories, Models and Methodology in Writing Research*, Amsterdam: Amsterdam University Press

van Eemeren F.H., Grootendorst R., Henkemans Snoeck A.F. (1996). *Fundamentals of Argumentation Theory*. NJ: Lawrence Erlbaum

van Eemeren F.H., Grootendorst R., (1994*).* Rational for a pragma-dialectical perspective. In F.H. van Eemeren, R. Grootendorst (Eds.), *Studies in Pragma-Dialectics*, Amsterdam, International Centre for the Study of Argumentation, Sic Sat

van Eemeren F.H., Grootendorst R., (1994a) Writing argumentative texts: From analysis to presentation. In F.H. van Eemeren, R. Grootendorst (Eds.), *Studies in Pragma-Dialectics*, Amsterdam, International Centre for the Study of Argumentation, Sic Sat

van Eemeren F.H., Grootendorst R.,(1984) *Speech acts in argumentative discussions. A theoretical model for the analysis of discussions towards solving conflicts of opinion*. Dordrecht/Cinnaminson: Foris Publications.

Govier, T. (1998) *A practical study of argument*. Belmont, California:Wadsworth Publishers. Co

Gasper D.R., George R.V., (1998) Analyzing argumentation in planning and public policy: assessing, improving, and transcending the Toulmin model. *Environment and Planning B: Planning and Design* 1998, 25, 367-390.

Hair, D.C. and Lewis, C (1990) Are argument representations schemes useful? University of Colorado technical report CU-CS-475-90, June 1990. Reprinted in F. H. van Eeemeren, R. Grootendorst, J.A. Blair and C.A. Willard (Eds.) *Proceeding of the Second International Conference on Argumentation*, International Society for the Study of Argumentation (ISSA), Amsterdam: SicSat 1991

Henkemans A.F. Snoeck (1992) *Analysing complex argumentation. The reconstruction of multiple and coordinatevely compound argumentation in a critical disussion.* Amsterdam: SicSat

Horvath, B. K., (1985) The Components of Written Response: A Practical Synthesis of Current Views. *Rhetoric Review*, 2 (January), 136-56

Keith W.K., Weiner A.W., Lesgold, A.M. (1991) Towards computer-supported instruction of argumentatio. In F. H. van Eeemeren, R. Grootendorst, J.A. Blair and C.A. Willard (Eds.) *Proceeding of the Second International Conference on Argumentation*, International Society for the Study of Argumentation (ISSA), Amsterdam: SicSat

Larkin J.H., Simon, H.A. (1987) Why a diagram is (sometimes) worth ten thousands word. *Cognitive Science* 11, 65-99

Larman G. (1996*) Applying UML and Patterns, An introduction to object-oriented Analysis and Design*. NJ: Prentice Hall

Oostdam R., de Glopper K., Eiting M.H. (1994) *Argumentation in written discourse: secondary school students' writing problems.* In F.H. van Eemeren, R. Grootendorst (Eds.), *Studies in Pragma-Dialectics*, Amsterdam, International Centre for the Study of Argumentation, Sic Sat

Oostdam R., Emmelot Y. (1991) Education in Argumentation Skills at Dutch Secondary schools. In F. H. van Eeemeren, R. Grootendorst, J.A. Blair and C.A. Willard (Eds.) *Proceeding of the Second International Conference on Argumentation*, International Society for the Study of Argumentation (ISSA), Amsterdam: SicSat

Rittel H., Kunz W. (1970) Issues on elements of information systems. Working paper #131, Institut of Grundlagen der Planung I.A., University of Stuttgart. In A. Dix, J. Finlay, G. Abowd, R. Beale (1993) *Human Computer Interaction*, UK: Prentice Hall

Ryan J. Norris S.P. (1991) High School Understanding of Argumentative Text. In F. H. van Eeemeren, R. Grootendorst, J.A. Blair and C.A. Willard (Eds.) *Proceeding of the Second International Conference on Argumentation*, International Society for the Study of Argumentation (ISSA), Amsterdam: SicSat

Sommers, N, (1982). Responding to Student Writing. *CCC*, 32, 148-56. Rpt. in J. Travers (Eds.) *Teaching Writing: Theories and Practices*. Glenview, Ill.: Scott, Foresman, 1988.

Scaife M., Rodgers, Y. (1996) External cognition: how do graphical representations work? *Human-Computer Studies*, 45, 185-213

Shum S., Hammond N. (1994) Argument-based design rational: what use at what cost? *International Journal of Human-Computer Studies*, 40(4), 603-652, available on http://kmi.open.ac.ul/sbs

Smolensky P., Fox B., King R., Lewis, C. (1987) Computer-Aided Reasoned Discourse or, How to argue with a Computer. In R. Guindon, (Eds.*). Cognitive Science and its Applications to Human Computer Interaction*, N J:Ablex

Streitz N., Hanneman J., Thuring, M. (1989) From Ideas and Arguments to Hyperdocuments: Travelling through activity spaces. In *Proceedings of Hypertext '89*, 34-64, ACM: New York.

Suthers D.(1998) *Technical Report: Computer aided education and training initiative, available* on http://advlearn.lrdc.pitt.edu/advlearn

Suthers D.(1999) Representational support for Collaborative Inquiry. In *Proceeding of the Hawaii International Conference on System Sciences*, January 5-8, 1999

Toulmin S., Rieke R., Janik A. (1979) *An introduction to reasoning*, NY: Macmillan Publishing

Warnick B. Inch E, (1994) Critical Thinking and Communication, The use of reason in argument, USA: MacMillan