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Learning Through Dialogue (LTD) - A toolkit to support the process of planning for effective use of dialogue in learning

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Abstract

This paper presents an implementation of a decision support system to help tutors think about ways of using dialogue to support learning. The approach adopted has been to develop a software toolkit around a knowledgebase of dialogue methods, to assist tutors in the reflection required during the planning and design of dialogue to support learning.

Keywords

Pedagogical issues, teaching/learning strategies, improving classroom teaching.

1. Introduction

The effective use of dialogue to support learning in Higher Education is complex and difficult. For educational practitioners with limited experience of dialogue methods, the task of designing (or redesigning) such teaching can be problematic and time consuming. The research described in this paper describes one strategy to support tutors in pedagogical use of dialogues. This project also works to contribute to wider issues about the development process for decision support toolkits, and the improvement of understanding about relative benefits of using dialogue to support different kinds of learning in different domains.

First the paper explores issues about the use of dialogue to support learning, followed by issues about software toolkits in general and their development. The paper then presents the design and development stages of "LTD – the Learning Through Dialogue Toolkit" itself, from initial design, through evaluation of a paper-based prototype, to full software implementation.

2. The use of dialogue to support learning

There are many techniques for using dialogue to support learning. New methods and modern interpretations of older ones have been encouraged by increased availability of Internet technologies and systems to support asynchronous communication. Examples of dialogue methods to support learning include Socratic approaches to repeated questioning, such as implemented the WHY computer-based system (Stevens, Collins & Goldin, 1982), and modern interpretations of Socratic dialogue, such as the theory of inquiry teaching proposed by Collins & Stevens (1991). Dialogue can be structured through formal rules for turn taking, such as the dialogue games described by Levin & Moore (1977). Others have explored apprenticeship models of the community of inquiry approach (the TAPS project, Derry 1992) and learning assistants to support collaborative dialogues (the MetaMuse system, Cook 2001).

There is certainly no single “correct” approach that will meet all pedagogic aims, and for educational practitioners with limited experience of dialogue methods, the task of designing (or redesigning) such teaching can be problematic and time consuming. Designing a computer-based system to support the planning for effective use of dialogue in learning is a non-trivial task, which we have tackled through the development of LTD, a software toolkit.

3. Toolkits to support decision making

A ‘toolkit’ is a software system to support a design process (in our case, the design of teaching that effectively incorporates dialogue methods). Toolkits support decision making based around an expert model of the design process – they provide a structure for decision making and can make recommendations, based on ‘goodness of fit’ between descriptions of problems elicited from the user and a knowledgebase of possible solutions. Oliver & Conole (1999) describe toolkits in more detail.

For the toolkit we describe in this paper we have followed the methodology for toolkit design (Conole & Oliver, in press), which can be summarised as follows:

- (A) Identification of a suitable theoretical framework for design
- (B) Toolkit specification (how can the range of options available at each stage be translated into a practical but flexible form of guidance for non-experts?)
- (C) Toolkit refinement: evaluating prototypes (how useful and flexible is the toolkit?)
- (D) Inclusion of user-defined features
- (E) The development of shared resources

For the LTD toolkit the first two stages (A and B), and the first iteration of stage C have been described in detail previously (see Cook & Oliver, in press), and are only briefly summarised here. The focus of this paper is in presenting details a **second iteration of the prototyping step (C)** – the development of a full software prototype of the LTD toolkit.

4. (A) Identification of a suitable theoretical framework for design

No existing model could be found that described the process of comparing and contrasting different discursive formats for education. Therefore relevant case studies were considered and the following 5-stage model was derived:

- Identification of learning need
- Elicitation of learning objectives
- Elicitation of detailed description of task and context
- The filtering of options and recommendation of suitable approaches
- Selection, investigation and adoption of a suitable approach by the user

5. (B) Toolkit specification: how can the range of options available at each stage be translated into a practical but flexible form of guidance for non-experts?

A prototype toolkit was designed around the five decision-making steps identified in the theoretical framework for the design task (steps 1 to 5 above). Descriptions are provided to the user at each decision-making step, and the user is required to perform an activity/make a choice, while able to interrogate options and knowledgebase contents. The toolkit approach requires the organisation of information in 'layers', allowing users to engage deeply with content/decisions they find important, and able to quickly skip over, or bypass completely, steps with less relevance to their particular teaching requirements.

A knowledgebase was designed to contain details of different kinds of dialogue methods (such as court of law, structured debates, and Socratic dialogue). To assist users in finding a good ‘fit’ between their teaching aims and available dialogue methods a ‘knowledge space’ was developed to differentiate between features of different dialogue methods. This knowledge space comprised the following set of criteria identified as useful for distinguishing between dialogue methods:

- Whether or not it is important to reach a ‘right’ answer.
- Whether the method emphasises collaboration or competition.
- The duration required for a dialogue of this type.
- The numbers of participants required.
- Issues of power relationships within the discussion.

These descriptors were adopted on their pragmatic value in discriminating between alternatives in a way that is likely to identify useful approaches. Since these descriptors are not necessarily independent of each other, nor exhaustive etc., part of the evaluation of our toolkit will require validation of this knowledge space.

The structure of the dialogue methods knowledgebase was based on this set of descriptors. Part of the design of the interactive aspects of the prototype toolkit involved asking the user to rate each of their learning objectives using this same mapping used to represent methods in the knowledgebase. For the toolkit design the questions asked and ranges of answers permitted were as follows:

- Is there a right/wrong answer? (Options: there is an absolute answer, there are criteria for ‘right’ answers, very open/free.)
- Should the dialogue promote competition or collaboration? (Options: there will be clearly identified ‘winners’ and ‘losers’, the dialogue will be highly competitive, some people will do better than others, success will only be judged in terms of the group as a whole, credit will be given for listening to others and drawing on evidence.)
- What will the duration be? (Options: hours, days, months.)
- What will the group size and level of tutor support be? (One interval, e.g. “25-30 students”, one integer.)
- Issues of power (who defines rules and roles?) (Options: defined and assigned by the tutor, negotiated between tutor and participants, determined by participants, no formalisation of power/roles.)

6. (C) Toolkit refinement: evaluating prototypes

A first, 'paper' prototype was developed and evaluated with users through the "Wizard of Oz" approach (see Cook & Oliver, in press). This paper-based prototype toolkit was tested with teachers/tutors, and evaluated to assess its suitability, ease of use, flexibility and relevance. The result was that the following decisions were made to refine the toolkit design, based upon the results of the prototype evaluation:

- reduce number of steps by requiring the user to focus on a single learning objective at a time (thus there are now 4 steps, with the new step 2 combining the original steps '2 Elicitation of learning objectives' and '3 Elicitation of detailed description of task and context')
- provide a range of detailed examples for each user input, so the user understands appropriate type of entry

Other design decisions implemented in the refined system include:

- allow non-linear navigation – so user can visit decision steps in any order, trying out different choices ("what if" scenario experimentation) and seeing how recommendations change
- knowledgebase entries rank criteria on a Real number scale from +1.0 to -1.0, the system returns 'goodness of fit' to the user in terms of an average match between user choices and knowledgebase entries in the range +100.0% to -100.0% (so a simple measure of closeness of match of alternatives is available, rather than simply the rank position of alternatives)

7. Second iteration of step (C) Toolkit refinement: evaluating prototypes

Building upon the findings of the evaluation of the paper-based prototype, a full software prototype has been developed and is the focus of this paper. The following diagram (Figure 1) presents a simple overview of the toolkit and interactions:

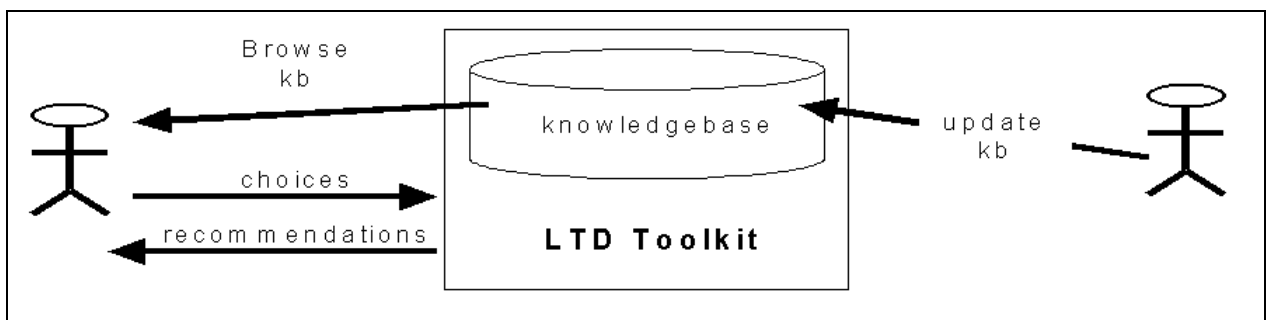


Figure 1: Overview of LTD toolkit.

Figure 2 illustrates a screenshot of the toolkit home page:

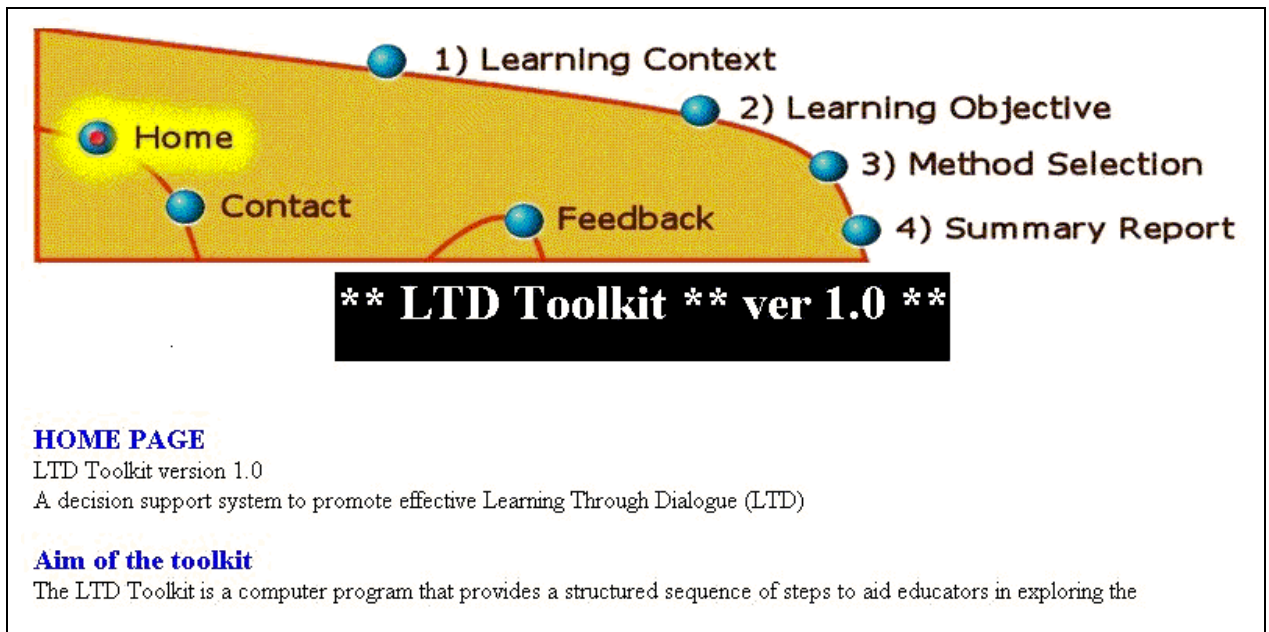


Figure 2: The LTD home page

Navigation is performed by clicking on the image map at the top of the window, or on the buttons on either side of the image map.

7.1 Step 1 – Learning context

Step 1 involves the entry of details about the learning context. The screenshot below (Figure 3) illustrates entry of details for Step 1.

DSL Toolkit version 1.0 Step 1 - Context where dialogue can support learning	
1.1 Course	<input type="text" value="COMP 2000 Professional Issues"/>
1.2 Student profile	<input type="text" value="year 2 computing BSc students"/>
1.3 Aprox. number of students	<input type="text" value="150"/>
1.4 Part of course where dialogue to be used	<input type="text" value="computer law"/>
1.5 Broad learning aim	<input type="text" value="argue applicable law to case students"/>
<input type="button" value="submit data"/>	

Figure 3: Learning context (Step 1).

7.2 Step 2 – Learning objective rating

Step 2 supports the user in describing in detail features of the learning outcome that the teaching/learning is to support. Textual descriptions of the learning objective, and how its achievement is to be judged are provided by the user. The user then rates their learning objective in terms of the knowledge map that encodes the knowledgebase entries. Examples of two of the questions, and structured choices for each have been implemented are as follows:

B: Degree of encouragement of collaboration

- "(doesn't matter)",
- "Individual competition required",
- "Individual competition encouraged",
- "Distinct contributions to group encouraged",
- "Collaboration within group encouraged"

E: Definition of power roles

- "(doesn't matter)",
- "Tutor assigns roles & rules",
- "Tutor and Participants negotiate roles & rules",
- "Participants assign roles & rules",
- "There is no formalisation of roles & rules"

The figure below is a screen shot of example entries and choices for Step 2.

DSL Toolkit version 1.0 Step 2 - Details of learning objective	
2.1 Learning Objective (LO)	<input type="text" value="Identify / apply compute misuse law"/>
2.2 How to judge achievement of LO	<input type="text" value="written report and oral argument"/>
2.3A Openness of domain	<input type="text" value="Open domain"/>
2.3B Degree of encouragement of collaboration	<input type="text" value="Collaboration within group encouraged"/>
2.3C Duration of learning/assessment experience	<input type="text" value="Over several months"/>
2.3D1 Group size	<input type="text" value="Exactly 6"/>
2.3D2 Level of tutor support	<input type="text" value="Exactly 1 tutor"/>
2.3D3 Scope of tutor support	<input type="text" value="The tutor(s) given in D2 above have to spread their tutorial support over all groups"/>
2.3E Definition of power/roles	<input type="text" value="Tutor assigns roles & rules"/>
<input type="button" value="submit data"/>	

Figure 4: Details of Learning Outcome (Step 2).

7.3 Step 3 – Method selection

Step 3 is where the toolkit ranks each method in the knowledgebase against the rating choices made by the user for the learning objective. Rankings can range from +100% to -100% - these figures are based on the mean of the closeness of the match between each criterion entry for a dialogue method and the actual ratings entered by the user. An example of the

presentation of ranked dialogue methods is illustrated in the following screenshot (at the time of writing only ‘court of law’ has a full knowledgebase entry, the knowledgebase is being populated with a range of dialogue methods over the next few months).

DSL Toolkit version 1.0 Step 3 - Selection from recommended LTD knowledgebase methods	
2.1 Learning Objective	<input type="text" value="identify / apply compute misuse law"/>
3.1 Currently selected dialogue method	<input type="text" value=""/> explain chosen method
Top 3 dialogue methods ...	Recommendation 1. <input type="text" value="court of law (100%)"/> <input type="button" value="choose"/>
	Recommendation 2. <input type="text" value="test 1 (-60%)"/> <input type="button" value="choose"/>
	Recommendation 3. <input type="text" value="(no more suggestions)"/> <input type="button" value="choose"/>
You might also consider ...	Alternative 1. <input type="text" value="(no more suggestions)"/> <input type="button" value="choose"/>
	Alternative 2. <input type="text" value="(no more suggestions)"/> <input type="button" value="choose"/>
You can also ...	<input type="button" value="Browse entire knowledge base"/> <input type="button" value="Add new method to knowledgebase"/>

Figure 5: Method Selection (Step 3).

A simple explanation facility is provided, providing details of the percentage match of each criterion entered by the user with the selected knowledgebase method. This is illustrated in Figure 6 below.

Explanation for scoring of method: <input type="text" value="court of law"/>	
DSL Toolkit version 1.0 Explanation of knowledge method score	
Criterion	
Your choice	Match with kb method
2.3A Openess of domain	
<input type="text" value="Open domain"/>	<input type="text" value="100%"/>
2.3B Degree of encouragement of collaboration	
<input type="text" value="Collaboration within group encouraged"/>	<input type="text" value="100%"/>
2.3C Duration of learning/assessment experience	
<input type="text" value="Over several months"/>	<input type="text" value="100%"/>

Figure 6: Excerpt from explanation of selected method score.

7.4 Step 4 – Summary Report

Step 4 collates all the entries by the user as a summary report for printing or saving to file.

An example screenshot from the toolkit presenting a summary report is as follows:

DSL Toolkit version 1.0 Step 4 - Summary report	
1.1 Course	COMP 2000 Professional Issues
1.2 Student profile	year 2 computing BSc students
1.3 Aprox. number of students	150
1.4 Part of course where dialogue to be used	computer law
1.5 Broad learning aim	argue applicable law to case students
2.1 Learning Objective (LO)	identify / apply compute misuse law
2.2 How to judge achievement of LO	written report and oral argument
2.3A Openess of domain	Open domain
2.3B Degree of encouragement of collaboration	Collaboration within group encouraged
2.3C Duration of learning/assessment experience	Over several months
2.3D1 Group size	Exactly 6
2.3D2 Level of tutor support	Exactly 1 tutor
2.3D3 Scope of tutor support	The tutor(s) given in D2 above have to spread their tutorial support over all groups
2.3E Definition of power/roles	Tutor assigns roles & rules

Figure 7: Summary Report (Step 4).

9. Conclusions and further work

The notion of principled design was one of five current strategic issues identified by Harasim (2001). In this paper we have described a software toolkit that allows practitioners to use dialogue in learning in an educationally driven way. We feel that LTD provides a simplification of the complex process of effectively incorporating dialogue into learning. The tool is flexible in that it allows users to skip over sections they feel irrelevant and engage more deeply with content they find important. The non-linear navigation supports easy identification of alternatives and the browsing of their knowledgebase entries.

The contribution of this paper is a report on the implementation of the LTD software prototype. The LTD system will, we hope, provide a useful decision support tool for teachers/tutors in all sectors of learning – enabling them to plan their approach to incorporating dialogue in their own learning context.

Future work will test our claims with user evaluations of the software prototype. We will then progress to the final two steps (D and E) in the toolkit design methodology.

10. Location of the toolkit and invitation to contribute

The toolkit can be found at the following URL.

www.itb.ie/staff/mattsmith/

The toolkit is implemented in HTML and Javascript.

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