DOCUMENT RESUME

ED 466 149 IR 021 219

AUTHOR	Cook, John; Oliver, Martin; Conole, Grainne
TITLE	Using Educational Dialogues To Design Systems for Learning.
PUB DATE	2001-06-00
NOTE	7p.; In: ED-MEDIA 2001 World Conference on Educational Multimedia, Hypermedia & Telecommunications. Proceedings (13th, Tampere, Finland, June 25-30, 2001); see IR 021 194.
PUB TYPE	Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	Action Research; *Computer Mediated Communication; *Computer Software Development; *Computer System Design; *Discussion (Teaching Technique); *Educational Technology; Foreign Countries; Models; Teacher Student Relationship
IDENTIFIERS	England

ABSTRACT

In this paper, a model is presented that uses educational dialogues to support the design process for learning support systems. The model is argued to provide a structure that links pedagogically motivated empirical studies of student-tutor-system interactions to problem specification and system design, and to result in the creation of learning technology systems capable of supporting learning. This model assumes an iterative life cycle model of software design, in which dialogue can be both an input (in the form of data for analysis) and an output (the result of learners using a well-designed system). The model has been derived from analysis of patterns of system development, and is related to approaches to cyclic models in educational theory and research methods. Two contrasting studies are used as illustrative examples of this iterative life cycle. The paper concludes by presenting a comparison between this approach and related developmental models: Kolb's experiential learning and Action Research. (Contains 11 references.) (Author)

Using Educational Dialogues to Design Systems for Learning

John Cook*, Martin Oliver** and Grainne Conole***
*Learning Technology Research Institute, University of North London.
** Higher Education Research and Development Unit, University College London.
***Institute for Learning and Research Technology, University of Bristol.

Abstract

In this paper, a model is presented that uses educational dialogues to support the design process for learning support systems. This model assumes an iterative life cycle model of software design, in which dialogue can be both an input (in the form of data for analysis) and an output (the result of learners using a well-designed system). The model has been derived from analysis of patterns of system development, and is related to approaches to cyclic models in educational theory and research methods. Two contrasting studies are used as illustrative examples of this iterative life cycle. The paper concludes by presenting a comparison between this approach and related developmental models: Kolb's experiential learning and Action Research.

Introduction

In this paper, a model that uses dialogue to support the design of systems for learning is presented. This model is argued to provide a structure that links pedagogically motivated empirical studies of student-tutor-system interactions to problem specification and system design, and to result in the creation of learning technology systems capable of supporting learning. Contrasting case studies are presented to support this claim.

The importance attached to dialogue in this model stems in part from the work of Lipman (1991), who has argued that dialogue with a 'community', including teachers and other learners, can play an important role as part of an interactive learning mechanism. As well as articulating and explaining a concept to peers and tutor, the learner will also internalise these dialogues. Self-reflection on these concepts can be fine-tuned and regulated by reference to a history of external dialogues that the learner has been exposed to. Furthermore, new conceptual understanding can be 'tested-out' by exposing them to further external dialogue within the 'community of learning'.

The model described in this paper has emerged from an analysis of ongoing development work. Its proposed strength is based on the realisation that common structures appear in a diverse range of development activities. In particular, this methodological framework has been synthesised from developmental work in subjects as diverse as Musical Composition (Cook, 2000) and curriculum design (Oliver and Conole, 1998; Kewell et. al., 1999b), demonstrating its transferability and validity. Our life cycle involves five steps: 1) problem specification, 2) educational dialogues and interactions are analysed and modelled, 3) results from dialogue analysis can be used as the basis for the design of technology-based educational systems and/or can be used to inform our educational practice, 4) a system is implemented that can be used to foster informed or principled educational dialogues, and 5) the system is evaluated with users. There are various issues involved with each step:

- At step 1 we need to decide if the application area is domain specific or more generic.
- Step 2 requires us to decide on what dialogue analysis and modelling techniques to use. There is a great number of techniques available, a discussion of which is beyond the

scope of this paper (see http://www2.unl.ac.uk/~exbzcookj/workshop/workshop.htm for the proceedings from a workshop that included talks on some of the approaches that are possible).

- It is not a question of direct transfer of expertise from human to machine, but rather to use human expertise, when *modulated* (rather than *transferred*) to the computational medium, as an appropriate starting point for system design, which can then be refined on the basis of evaluation with users.
- When moving from design to implementation two possible choices are that of going for an implementation of the whole design in one go (the big bang) or of adopting an incremental approach that involves the repeated use of prototypes to elicit user requirements. In our model we favour the latter approach.
- Evaluation can also be problematic. As has been discussed, a common problem with evaluation is that designer will adopt a familiar strategy, as opposed to the most appropriate strategy, and hence will not be able to address key issues. In addition, it may prove appropriate to use different evaluation strategies at different iterations within the cycle (Oliver, Conole et al., 1998).

The purpose of this paper is not to provide solutions to all of the above issues. Rather, we make use of two studies to explore aspects of these design issues and develop a deeper understanding of this model. To this end, the paper concludes by presenting a comparison between this approach and related developmental models: Action Research and Kolb's experiential learning.

The first study: a support tool for musical creativity and reflection

The first study used steps '1 through 5 and back to step 2' of our life cycle to develop a learning support tool for musical creative reflection. Cook (1998) has used a dialogue analysis and modelling methodology to develop a computer-based pedagogical agent for supporting musical composition learning. Cook has explored the life cycle as follows:

1. *Problem specification.* Evidence supports the view that the use of sequencer software in the current training of composers in higher education appears to limit creative thinking in some learners.
2. *Dialogue analysis and modelling.* Cook (1998) has analysed teacher-learner dialogues in a formal manner; one outcome of this analysis being prescriptive models of interactions described at the level of participants' goals and communicative acts (the latter being seen as a way of achieving goals).
3. *Design of technology-based educational systems.* These dialogue models (generated by step 2) were then used in the design of an computer-based pedagogical agent called MetaMuse (Cook, 2000) that was able to engage in interactions that aimed to promote creative reflection.
4. *Implementation.* MetaMuse, a pedagogical agent for supporting undergraduate musical composition learning, has been developed as a result of employing the design approach described above.
5. *Evaluation of the system with users.* MetaMuse has been evaluated with users (Cook, 2000). The sample size of users used in the evaluation, at 17, was small and so some caution is required when attaching significance to these results. Given this reservation, however, the results seem favourable: the total average response score for user attitudes to MetaMuse — elicited by questionnaire following a session with the system — was

3.63 (out of 5). However, a question that asked users to evaluate the help screens and messages provided by MetaMuse received the lowest average score (2.76 out of 5). The help screens and the language used by MetaMuse clearly need improving. (Provision of help was not a focus for the initial version of MetaMuse.)

Current work involves two related projects. The first project aims to improve the guidance and explanations provided by MetaMuse by incorporating model-based training techniques (new problem, step 1 of the life cycle). The goal of such an undertaking is to provide enhanced access to learning over the Internet in a domain (musical composition learning) that has traditionally had little computer-assisted support (i.e. training in musical composition). The second project involves an analyses of transcriptions of pairs of collaborating learners using MetaMuse (generated by the study described by Cook, 2000). The initial evaluation of the MetaMuse pedagogical agent (i.e. step 5 above) did not provide adequate insight into the following question (new problem, step 1 of the life cycle): what are the interactive means by which learning agents engage in cooperative problem-seeking? This second project will, therefore, commence from step 2 initiating a second loop around the life cycle (i.e. more dialogue analysis and modelling).

The second study: pedagogic re-engineering

In contrast to the first case study, the second project started from a different point in the model. This work concerns Media Adviser (Kewell et. al., 1999a), a software tool that supports "pedagogic re-engineering" (Nikolova and Collis, 1998): changing the structure of a course and the nature of its activities in order to take advantage of Learning Technology. The software supports a five-stage process of course description, analysis to identify strengths and weaknesses, identification of alternative teaching techniques, the creation of revised curriculum plan(s), and a planning process that identifies the steps needed to implement the new curriculum. Media Adviser comes into its own when used as a discussion artefact (Kewell et. al., 1999b), and consequently dialogue has been used as an integral part of the tool's development (Oliver and Conole, 1998).

The project involved implementing a software tool based on an existing design, and then testing this with users. This then led to the refinement of the software tool, involving an analysis of users' dialogue, redesign and re-implementation.

4. *Implementation.* The specification for the functionality of Media Advisor and a high-level design outline was given to the project team, who implemented a prototype.
5. *Evaluation of the system with users.* The software was used as part of a professional development programme, in which users worked together to address problems of curriculum design. This process was observed and video recorded, and the data was subsequently transcribed.
2. *Dialogue analysis and modelling.* The dialogues that were observed in the evaluation phase were analysed in order to identify strategies for use, potential refinements and unanticipated needs or issues.
3. *Design of technology-based educational systems.* The software tool was refined and extended to address the findings of the analysis phase. This included enhancing the visual feedback on course profiles provided by the tool, increasing the flexibility of its modelling component, and allowing users to customise content with a 'save and load' facility. In addition, the navigation through the software was re-thought.

4. *Re-implementation.* Following the design of additional functionality and revisions to the interface, the software was re-implemented.

In summary, then, this second study started at step 4 of the model, progressed to step 5, looped back to step 2, and then moved on through steps 3 and 4. Current work on this project involves a second round of empirical evaluation of the software tool.

It is worth noting, however, that this project work built on existing research that can be mapped onto steps 1, 2 and 3 of the first cycle of the model. What this illustrates is that any research or design process is likely to draw on the full range of steps in the process, but that these may be carried out by separate researchers or project teams. Consequently, any self-contained team may only be aware of their progress through sub-sections of the model.

Discussion

The cases described above illustrate the model elaborated in this paper. However, it is useful to consider whether this model is actually innovative, or if it is simply a re-naming of an existing approach. To demonstrate the distinctiveness of this model, this section includes a comparison between it and two other models, each of which relates to a different aspect of its process: Kolb's experiential learning and Action Research.

Kolb's experiential learning cycle

Just as systems design has shifted from system- to user-centred models, current theories of learning have moved from teacher-oriented to learner-oriented. Particularly relevant to this discussion is the model provided by Kolb's experiential learning cycle (Kolb, 1984). This model can be taken to explain the process whereby the designer learns, through experience, how to improve their system. Importantly, the "experience" phase of this model relies on first-hand immersion in (or observation of) real use.

This cycle fails to capture key elements of the model described in this paper. At a simple level, the mapping between stages (e.g. abstract reconceptualisation and design, experimentation and implementation, concrete experience and evaluation) highlights that the process in this paper is geared towards a practical process, rather than reconceptualisation. It is a process that deals with creation and development, as opposed to being purely concerned with the development of knowledge.

Additionally, the design process involves a 'scoping' element (problem specification) that is missing from Kolb's cycle. The experiential learning cycle assumes that the remit for learning is given; the model in this paper places the responsibility for this scoping with the designer.

Finally, experiential learning also leaves the nature of "experience" undefined; in this model, a tighter focus is presented. The purpose of this is to concentrate on dialogue as a key indication of learning and development (e.g. Lipman, 1991). This reflects the aim of this model, which is to design systems that successfully support and structure learning through dialogue.

Action Research

Action Research is closely related to experiential learning, and follows a similar cyclic model (see, e.g., Zuber-Skerrit, 1992). The key difference between the two approaches can be argued to be one of emphasis. Experiential learning is closely linked to personal development (sometimes in the guise of Action Learning; e.g. Peters, 1998), particularly through reflective practice. It also focuses on the acquisition and development of concepts. By contrast, Action Research normally includes an element of dissemination (making it

partly a public process, rather than an exclusively private one) and is concerned with the identification and development of theories. In particular, it is viewed as one method of building grounded theories, and has been linked to Habermas' conception of the organisation of enlightenment in critical communities (Zuber-Skerrit, 1992).

This model described in this paper does not place such predetermined restrictions on the designer, but instead responds to their personal interests. As a consequence, the process could lead to *either* type of output, depending on the focus of the work and the context in which it is carried out. For example, immediate, local solutions can be created through the design process. In addition, more general schemas for design can evolve through the repeated application of this process, and through reflections on problems that emerge.

One way of determining which of these emphases will emerge lies in the choice of evaluation strategy employed during the cycle. Traditional assumptions about transferability of evaluation findings suggest that highly authentic approaches will be best suited to local solutions, whilst controlled evaluations will support generalisations (Oliver et. al., 1998). Either approach could be adopted within this model.

One commonality between all of the models discussed in this paper is the use of iteration. One of the strengths proposed for Action Research, for example, is that the process is incremental and iterative, leading to a process of continual improvement. A similar argument is made for the model outlined here. This is particularly true given its emphasis on users and learning, rather than systems and teaching, which lies at the heart of improving the usability of learning technology.

However, one key difference between these models concerns the scope of their iterations. Action Research, as with experiential learning, assumes that iterations will involve complete repetitions of the four-stage process. The model proposed here is more versatile; in it, iterations may occur at one of four levels:

1. Re-implementation of the tool, necessitated by the identification of bugs or errors
2. Revisions at the level of design, aimed at improving usability (a link back from evaluation to design)
3. Reformulations that respond to unexpected patterns of use or to the recognition that current analytical techniques have not adequately explained the structure of the dialogue (a link back from evaluation to analysis)
4. The identification of a completely new (but probably related) problem, requiring a distinct project that may replace or run in parallel with the original one (a link back to the start of the process)

Conclusions

In this paper, a range of cyclic models for development or the identification of good practice have been identified. A further cyclic model has been elaborated which focuses on the role of dialogue in design. This has been shown to be distinct from existing models, in particular in terms of the flexibility of its iterations and its focus. Two key features of this model are worth emphasising.

Firstly, it is iterative in nature, which necessarily engenders a continuous process of research and development. Above we have described how our model has already investigated a limited set of cognitive and social processes that underpin the process of creative system design and innovation.

Secondly, it illustrates how existing models can be adapted and customised in order to provide a detailed and relevant step-through for design processes in specific areas. Indeed,

because of the diverse domains presented in our two studies, we claim that our model has a high degree of transferability and validity.

The current version of this model represents at least one iteration through a reflective cycle, such as that of Action Research, for the authors. It draws on the identified models, and on experiences of applying these in a research context. Reflections on these experiences identified refinements and changes, and also commonalities between practice in different research projects. These reflections led, in turn, to the model described above. This can be viewed as an attempt to develop a theory that can be used to explain and structure the design of systems. The next step will be to undertake further iterations of self-reflection in order to refine the model further. One aspect of this will be to consider how this model relates to project management and to the structure of research projects. The work will involve applying the refined model, both to further iterations of the cases described in this paper and to new projects, and then further developing the model based on these experiences.

References

Cook, J. (1998), 'Mentoring, Metacognition and Music: Interaction Analyses and Implications for Intelligent Learning Environments', *International Journal of Artificial Intelligence in Education,* 9, 45-87.

Cook, J. (2000). Evaluation of a support tool for musical problem-seeking. *ED-Media 2000 - World Conference on Educational Multimedia, Hypermedia & Telecommunications.* June 26-July 1, 2000, Montréal, Canada. AACE.

Kewell, B., Oliver, M., Beaumont, D., Standen, R., Hopkinson, S. and Conole, G. (1999a), *The creation of Media Advisor: from theoretical framework to multimedia resource*, ELT report no. 5, University of North London.

Kewell, B., Oliver, M. and Conole, G. (1999b), *Assessing the Organisational Capabilities of Embedding Learning Technologies into the Undergraduate Curriculum. The Learning Technology Studio Programme: a case study*, ELT report no. 10, University of North London.

Kolb, D. (1984), *Experiential learning: experience as the source of learning and development*, Englewood Cliffs, New Jersey: Prentice-Hall.

Lipman, M. (1991), *Thinking in Education.* New York: Cambridge University Press.

Nikolova, I. & Collis, B. (1998), Flexible Learning and the Design of Instruction, *British Journal of Educational Technology*, pp.59-72.

Oliver, M., Conole, G., and Kewell, B. (1998), 'An overview of an evaluation toolkit for learning technology use', in Dooner, M. (ed.), *Proceedings of the IEE Colloquium, Exploiting Learning Technology: issues for learners and educators*, pp. 1/1-1/4, London: Institution of Electrical Engineers.

Oliver, M. and Conole, G. (1998), *Re-implementing the pedagogic toolkit to support staff development*, ELT report no. 4, University of North London.

Peters, J. (1998), 'A learning organization's syllabus', in Teare, R., Davies, D. and Sandelands, E. (eds.), *The Virtual University: An Action Paradigm and Process for Workplace Learning*, pp. 288-297, London: Cassell.

Zuber-Skerrit, O. (1992), *Action Research in Higher Education*, London: Kogan Page.

U.S. Department of Education
Office of Educational Research and Improvement (OERI)
National Library of Education (NLE)
Educational Resources Information Center (ERIC)

NOTICE

Reproduction Basis

☒ This document is covered by a signed "Reproduction Release (Blanket)" form (on file within the ERIC system), encompassing all or classes of documents from its source organization and, therefore, does not require a "Specific Document" Release form.

☐ This document is Federally-funded, or carries its own permission to reproduce, or is otherwise in the public domain and, therefore, may be reproduced by ERIC without a signed Reproduction Release form (either "Specific Document" or "Blanket").

EFF-089 (5/2002)