Modelling and feedback: Providing constructive guidance through a web medium

Shelda Debowski
Murdoch Business School, Murdoch University

With the increasing use of the world wide web as an instructional medium, there are still many challenges awaiting educators. In particular, we need to explore how we can provide feedback and guidance for those learning more complex principles and applications. This paper explores some of the strategies which may be used to provide feedback and further models of good practice to learners. The methods are currently being developed and tested using a database searching task, and illustrate the potential for capturing learner response sets and using these to structure the learning cues provided online. The paper identifies some changes to instructional design methods which may need to be integrated into course planning if educators are serious about quality online instruction.

Online Learning

The world wide web has created many possibilities for training and education. Increasingly, tertiary institutions are exploring the use of web-based instructional processes as a possible learning medium – either in conjunction with text and class-based processes, or as an alternative mode of instruction (Connolly, 2001). Online instruction has many possible benefits, particularly for those undertaking distance education. It can provide a more flexible learning environment for students. With its capacity to provide visual, aural and textual stimuli, and a menu-based instructional set of options, it offers both flexibility and the potential for individualised learning. However, online instruction suffers from a number of limitations. It lacks the direct and immediate contact between the learner and the teacher which characterises face-to-face instruction. A teacher in a class setting is provided with numerous opportunities for interaction and guidance. A key element of the teacher's role is to provide feedback to learners, so that they may build accurate and effective understanding of the desired concepts and skills to be acquired. This feedback can be diagnostic, that is, tailored to the individual's needs, or may be more generally provided to the learner population. Its provision ensures that the learners are able to identify deficient skills components, and develop these more effectively. While multimedia have offered the opportunity to incorporate a range of experiential and learning avenues to enhance skill acquisition, they are currently less capable of providing the diagnostic and review processes which target learning problems in a timely and focussed manner.

Certainly, learners may obtain a strong understanding of the content and view examples of good practice through web-based learning, however, a great challenge lies in creating opportunities to practice those competencies and gain targeted feedback. Where the knowledge and understanding to be gained relates to simple, predictable and controllable tasks, forms may be created to provide immediate response on the selected answer. This is demonstrated by the widespread use of forced option answers, where a learner is provided with a range of choices, and must select the option which he or she believes to be most

appropriate. In this form of feedback, the designer is able to construct feedback, by anticipating likely incorrect assumptions which the learner may have made when selecting a particular answer. These forms of feedback enable learning to be guided and structured around the correct responses of the student. In this context, it is relatively manageable to provide opportunities for quick feedback to guide correct understanding.

As students move toward a university setting, they are less focussed on acquiring facts or building simple cognitive processes, and are more challenged with the building of complex, unstructured and analytical processes. Task complexity has been defined in terms of three characteristics (Wood, 1986). First, complex tasks are often high in component complexity, in that they require a large number of distinct acts to be performed in order to complete the task. Second, they are high in dynamic complexity, that is, each step that is undertaken during the problem-solving process leads to a new set of decision conditions. For example, the information gained from the first step, is used to predict and interpret suitable responses for the next step. Thus, the learner is often required to maintain a close awareness of each stage of the process which is undertaken. Finally, many problem based learning tasks build in coordinative complexity, in that the learner must monitor and merge the results of prior steps into subsequent actions, and so, must maintain control over both past and current strands of investigation. In a face-to-face instructional environment, a teacher may scan the lines of work and identify areas of error or problems, and explain where – and why- difficulties occurred. The instructor may also model an improved strategy, which will better reflect the core principles. An online environment is less flexible in providing this level of directed guidance and response to complex learning processes.

Whilst online learning provides opportunities to interact with the instructor through bulletin boards, online tutorials and similar real-time interactions, these can be time and labour intensive for instructors, and may not be available at the opportune moment for those seeking this guidance. As online instructors, we must work toward developing some additional strategies for providing further guidance and support to learners at point of need – whether the skills are complex or simple. Web based instruction has become a significant adjunct to face to face instruction – particularly for the tertiary sector. However, we need to strive to improve our support to the individual learner through further development of our electronic learning strategies. This paper reports some preliminary experiences in trying to construct additional mechanisms to provide feedback and guidance to online learners as they build information search competencies.

The Information Search Project

Information seeking is a core competency for those wishing to work, or function as citizens in our world (Debowski, 2002b). Increasingly, there is an expectation that adults will be able to effectively search for information and then build informed judgements to make decisions. The development of information seeking skills commences at primary school level, and continues throughout a young person's education. At the tertiary level, there is further provision of learning opportunities to enable students to build better skills. Most universities offer an orientation programme to their new intakes, in which library skills are a key focus. The development of information seeking competencies requires a range of conceptual principles and cognitive skills to be acquired and applied. For example, information seekers must analyse their topic and identify the core information components. They then need to define these, using terms which are likely to match those used by the information providers. In searching for these terms, they must also combine the retrieved sets of information appropriately to develop an accurate representation of the information available. These

strategies can be applied across a number of information environments, such as the internet or when searching literature databases.

Most information seeking fits the definition of complex learning (see Wood, George-Falvy and Debowski (2001) for a more detailed explanation.) The rate of expansion of the World Wide Web and of information sources has resulted in a constant expansion of the set of likely retrievable information. This necessitates very careful defining and refinement of information search processes. Most search tasks require the integration of three or more core concepts to adequately pinpoint the specific search requirements. This makes the search process both convoluted and complex. In fact, there are a number of problems which emerge as the searchers conduct their explorations (Debowski, 2001), and these often reduce the likelihood of successful capture of suitable sources of information. These problems relate to the background skills of the learner in defining knowledge and categorising terms, the integration of Boolean logic to manage the concept development (Houghton & Houghton, 1999) and the overall process of problem solving. After three hours, for example, most learners still demonstrate numerous errors and inconsistent search practices (Debowski, 2001). Further, they tend to revert to simpler, less demanding search processes unless the initial models of search are reinforced and reviewed regularly (Wood, Debowski and Goodman, 2001).

The development of information seeking skills has been the focus of a series of investigative studies which have enabled both university students and local community members to acquire more extensive strategic skills in information seeking (see Debowski (2002) for a summary of these studies). Participants have been introduced to information seeking, and provided with advanced strategies to enable them to manage complex search processes. The searches undertaken by the participants are complex, with a range of three to four concepts included in each task. The search histories of the participants are recorded and analysed to identify the concepts definition and the search strategy skills acquired.

The information search task operates at two levels: a conceptual level, where the key concepts are analysed, defined and developed as keywords, and a strategic level, in which the sets of concepts and keywords are developed and integrated into various combinations. While initial training provides preliminary models of these processes, the learner often reverts to more basic strategies once complex tasks are being explored – even when he or she has been successful with simpler tasks! The complexity of the search exploration necessitates a lengthy process of learning and reconsolidation to build the search skills to higher levels of expertise. This is the type of learning that lends itself well to the provision of additional learning support mechanisms – such as feedback and modelling.

The initial project studies comprised face-to-face instruction in small groups and explored a range of training and feedback mechanisms which enhanced the learning processes of the participants (e.g. Debowski, Wood & Bandura, 2001; Wood, Debowski & Goodman, 2002). However, more the two most recent studies have aimed to develop online instructional formats via a web-based interface. The provision of diagnostic feedback and effective modelling of the desired search protocol is more challenging to integrate into this electronic, self-directed format. This paper reports some of the current strategies which are being developed and integrated into the e-learning environment in the Information Seeking Project in preparation for a further study in 2002/3.

Feedback and modelling complex behaviours:

Learners seek to gain guidance from a number of sources during the skill acquisition phase. Modelling offers an important means of demonstrating required behaviours, as it enables a building of a cognitive framework which can be applied in subsequent practice, and also assures the learner that a successful process is both feasible and achievable (Bandura, 1986). This is a commonly used method of instruction, in which learners are provided with an example of the process or its sub-components, to demonstrate the key principles which must be integrated into future practice tasks. In the case of complex learning, it can be particularly powerful in building a learning framework and understanding of how theory is actually applied (Debowski, Wood & Bandura, 2001). Modelling is a useful source of continuous guidance throughout the initial conceptualising of the process, and its subsequent enactment and refinement by the learner (Bandura, 1997).

There is a growing understanding of the ways in which feedback operates, and can be constructed. Kluger and De Nisi (1996) argue that successful feedback strongly focuses on the task, and directs the learner's attention to this. This assists the learner in exploring naturally occurring performance information from the task, and enables the gaining of better insights as to the task and its composition. As tasks become more complex, it becomes more difficult to directly interpret sufficient information about the corrective strategies, and the steps involved may become more extensive and convoluted (Payne, Bettman and Johnson, 1993; Wood, 1986). Feedback relating to the required behaviours, strategies or expected outcomes are less readily provided and obtained. At the same time, learners need more extensive information about their performance and their achievement of the skills which should have been demonstrated. Feedback that provides information on the effectiveness of particular strategies, and their reflection of the learning principles needs to be provided. This feedback emphasises a focus on the task and its completion using the appropriate strategies and behaviours which have been taught (e.g. Balzer, Doherty & O'Connor, 1989; Earley, Northcraft, Lee & Lituchy, 1990; Locke & Latham, 1990). Information is provided on both the functional validity of the strategy, and the important features of the task. Both help to reorientate the learner toward a better understanding of the key skills which must be acquired and applied (Benson & Onkal, 1992; Schunk & Rice, 1991). This is particularly powerful if it is further linked to the initial instructional model which was taught to the learner, and if that model is reinforced during the review process.

Learners seek feedback from a range of sources when learning new processes (Goodman, 1998). Their own understanding of the task serves to inform their personal judgement as to the suitability of their actions. In addition, they seek to gain information from the context in which they operate, and from expert sources, such as an instructor. There is a reduction in contextual and expert mediated feedback in an electronic learning environment. Instead, the learner becomes increasingly reliant on direct support from the instructional screen. Whilst this can be generated for simple tasks, it is less easily built into web-learning environments when the learning performance tasks are complex, and a range of learner responses may be generated for any stage of the task.

Providing Electronic Modelling and Feedback – Some New Strategies

Feedback on complex tasks requires additional investigation and planning. The simple forced option approach used for many online learning processes does not allow the learners to explore and construct creative and responsive solutions. Instead, they are controlled to a large extent, and limited to a pre-determined range of responses. In a complex information search process, this form of structuring could be used, but would limit the adaptability and depth of understanding acquired by the learner. Instead, learners need to explore their problem space, and to become proficient in extracting answers which are based on their prior knowledge and skills. Thus, this project aims to provide feedback to learners who have been able to work from their own knowledge base, rather than a highly structured and orchestrated learning context.

The ideal support mechanism for novice learners of complex processes is to receive feedback on their performance as they work through the task (Goodman, 1998). This can be challenging within an online learning environment, since the instructor needs to be able to predict likely wrong and right answers, and to provide guidance on these in a flexible format. This advanced level of feedback and guidance requires considerable pre-planning and testing, so that a knowledge of learner responses can be accrued.

As previously noted, the information seeking task operates at two levels: the conceptual definition, and the strategic management of the information sets. The concept definition level enables the development of feedback on the suitability of the terms selected, and their reflection of the scope of the topic. To provide feedback on this performance area, data sets of learner strategies and keywords are being collected for a number of test tasks. A data set of correct and incorrect keywords has so far been developed, for example, using expert searches, the searches of sixty participants, and thesaurus definitions for three tasks. These responses will be integrated into the training programme, so that a wider set of answers can be anticipated and responded to. Where a learner selects another option which has been missed, this will be added into the set for future reference. While it is unlikely that this will fully capture the range of likely responses, it is hoped that it will enable better provision of online support to learners. The range of items identified by the participants provides a sample of real practice, as well as the normal best practice, to facilitate in the preparation of cued examples which might prompt the learner. By seeking an expansive set of both error practice and best practice, there is a stronger likelihood of guiding the learner into better search choices. This form of guidance and feedback enables better guidance of the learner during each step of the process, but is time consuming and requires pre-planning in order to sample learner behaviours. A further benefit of this form of analysis is that the instructor may identify instructional deficiencies, and correct these in the initial instructional programme. Thus, while time consuming, this level of analysis and review may be both informative and valuable in providing more constructive feedback on the concept development level.

At the strategic level, there is enormous variation in the search strategies employed by the learners. While these could be mapped, the diversity of the responses, and the complexity of the entangled search linkages creates more challenges for building effective feedback. In this situation, modelling is being employed as an additional support infrastructure. Two forms of model options are under development . The first offers a complete view of a completed search, from the initial definition, to the final resolution and amalgamation of concepts. The second enables the searcher to click on a particular stage of the search process, and to read a short explanation, and a view a demonstrated process. Hopefully, these will help the learner to better monitor the search process while also operating at the conceptual level.

A third strategy being tested is to encourage learners to self-evaluate their own performance. To incorporate this approach, it is necessary to consider the key criteria which should be demonstrated by the learner, and to ensure these are well-introduced during the instructional process. For example, participants are taught to consider how their search reflects the depth of search and sequencing of the search steps which are undertaken by experts, and which they are encouraged to apply (see Debowski (2002a) for an explanation of these strategic processes). Learners will be asked to evaluate their own searches using these same criteria. The use of the same evaluation structure by the participant learners reinforces the initial teaching strategy, and also encourages stronger levels of self-awareness. This is a cost effective means of building stronger strategy awareness, and can ensure that the learner re-orientates back to the core strategy which should be reflected. Thus, this is a relatively easy way to reinforce the initial instructional process, and to also provide a feedback mechanism which is available at all times. It seeks to empower and inform the learner. It also provides the instructor with a means of measuring learner self-awareness, since these responses can be recorded on the self-evaluative form.

The personal feedback evaluation is made much richer through a comparison of the model of best practice provided as an option on the screen, with the participant's own search sequence, since it serves to highlight areas of further improvement which could be undertaken, and also illustrates the particular stages which may need refinement. In the case of database searching, it also enables a better sense of search outcomes, as the learner may then also review the number of records retrieved and compare it with an expert benchmark (Benson & Onkal, 1992; Ilgen, 1971). This type of guidance also encourages a stronger focus on the task and the information which may be gained from analysing performance on the task.

These three feedback mechanisms have been designed to provide disintermediated feedback to the learner, despite the absence of the instructor. They enable the capture of typical search behaviours, and the use of this information to provide formatted responses, self-managed feedback tools and modelled feedback templates for the learner. While ideally suited to the online learning environment, they also make eminently good sense in normal instructional contexts.

Implications for Online Design

Electronic learning has much potential. However, they may be much less effective in building complex skills and competencies, due to their limited provision of feedback and modelling. Online instructional designers need to review how they provide these forms of support through their learning processes, particularly for those seeking to use the program outside normal hours.

A key challenge relates to the identification and analysis of problems and typical processes evidenced by the e-learner. The inclusion of activities which allow the capturing of learner responses, and enable better analysis of any problems, needs to be considered as part of the electronic development process (see Littleton & Light, 1999). This reflects a similar concern to that required of teachers involved in face-to-face instruction. However, this is a different approach to that used by many designers at present, where the development of learning materials tends to be a one-way process. While the analysis of the interactions would add additional load to online instructors, it would also ensure that the learners are better supported and reflected in the resultant materials.

The provision of feedback needs to be regarded as a high priority. This needs to extend beyond the forced option format, and should reflect a stronger understanding of the likely sources of error which may occur. The identification and analysis of problems, and the integration of feedback relating to these issues will greatly enhance the richness and worth of the online instructional medium. Teaching students to self-evaluate could also be a further, very productive mechanism for self-learning and skill development.

Finally, online instructors should consider the value of providing models – of both good practice and principles. These should be readily accessed from any screen, and should reflect the initial instruction which was provided. Complex learning particularly needs these cues and supportive mechanisms.

Conclusion

These strategies are still being tested, but they do offer promise for the future as we move toward increasing reliance on online instruction. As educators in this medium, we need to consider the challenges facing those learning through web-based training. They should be provided with effective support and feedback mechanisms to enable effective learning transfer. This is particularly critical when the instructional task relates to complex learning which requires multiple competencies to be developed.

We are faced with many challenges in this globalised educational environment. If education via a technological interface is to be an effective and quality alternative, we need to address a number of questions. For example, how can the learner be provided with examples of high quality outcomes, to create some standards of performance? Second, how can learners be encouraged to use these sources of guidance in a self-managed learning environment? Third, how can the instructor identify the types of errors and problems which are likely to occur? Fourth, how might these problems be generalised and developed into feedback models for learners? Hopefully, these developing strategies might offer some insight to others who are endeavouring to provide a quality educational experience.

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