Resource Based Learning and Problem Based Learning within a Psychology curriculum, two complementary approaches?

Wilco TeWinkel¹, Jeroen van Merriënboer² & Henk Schmidt³

Abstract

Problem Based Learning is a relatively new form of instruction and is over the years met with great enthusiasm. However, through continuous interaction with educational practice changes have been made in the way PBL is implemented at the University of Maastricht. Students expressed their discomfort especially related to the period of self-study in which they have to go out to look for literature. Students reported that they did not, or only to a limited degree, seek and read literature on their own. When they did do so, they often judged the quality of the information and the relevancy of the literature to the learning goals as poor. Students also considered the amount of time involved in looking for information as disproportionately large. One of the changes has been to supply them with a list of literature references they may want to consider during their self-study. In this paper it is argued that this “solution” seriously reduces the ownership of the students over their learning process. An approach that acknowledges and supports the learner-centeredness in the learning process is put forward. Instead of offering students literature references specifically suited for every specific problem, a large database is offered containing hundreds of high quality research articles suited for many different courses revolving around the same theme. It is already known, however, that this approach is not without problems. Resource Based Learning without instructional supports turns information search into information discovery, often resulting in coping strategies rather than learning strategies. In research following to this paper an attempt will be made to identify some of the experienced difficulties using the Cognitive Load Theory (Sweller, 1988, 1994; Sweller, van Merriënboer & Paas, 1995). Concrete suggestions for the design of the environment used for the RBL-approach are expected to result from this research.

Introduction

Problem Based Learning (PBL) is a relatively new form of instruction with a long intellectual history. Its roots go directly back to the American Functionalism (Dewey, 1902; 1929) and the “learning by discovery”-movement (Bruner, 1959). It can even be argued that the Greek already employed this line of teaching with their dialogue method: the teacher poses a problem and guides students towards the solutions by means of questioning. For Dewey, intrinsic interest of a student in a subject was a condition without which no meaningful (read: incorporated in the life of the child) learning could take place, and therefore the curriculum should be student-centred.

¹ Correspondence concerning this paper should be addressed to: Wilco TeWinkel, Department of Experimental Psychology, Maastricht University, P.O. Box 616, 6200 MD, Maastricht, The Netherlands. Electronic mail may be sent to: w.tewinkel@psychology.unimaas.nl. Online: www.unimaas.nl/~wtwinkel.
² Educational Technology Expertise Center (OTEC), Open University of The Netherlands, Heerlen, The Netherlands.
³ Department of Experimental Psychology, Maastricht University, Maastricht, The Netherlands
PBL is an approach of the educational learning process in which the students tackle problems in small groups. The problems that form the basis of study are usually descriptions of phenomena or events that can be observed in reality and that have to be analysed by the group using the available prior knowledge without consulting the literature first. During the small group discussions students clarify unclear words/concepts to one another, they discuss about what they think is the nature of the problem, and then they engage in a brainstorm. After the brainstorm they summarise the ideas by systematically classifying them. At the end of this first discussion, they agree on those issues they feel are the most important and therefore deserve most attention in the literature search. At this moment chemistry has to happen, students have to become involved and committed to the problem. They have to take ownership of the problem and have to get intrinsically motivated by it, they have to become curious and committed to solving the questions raised by themselves. The small group discussion is therefore vital in PBL. When the group meets again, the students will try to tackle the problem once more in order to check whether the new information enables them to come to a better understanding of the elements of the problem (Schmidt, 1990).

In everyday life however, this description does not entirely match with the activities that are actually undertaken by the students. A questionnaire submitted to all students and teachers at the Department of Medicine and the Department of Law at the University of Maastricht revealed that students did not, or only to a limited degree, seek and read literature on their own. When students did individually seek and read literature, they often judged the quality of the information and the relevancy of the literature to the learning goals as poor. Finally, students also indicated that the amount of time involved in looking for information was disproportionate to the amount of time involved in reading and studying it (Eurelings & Ronteltap, 1996).

Added to these general problems with self-study, are the problems that are typical for social sciences. Due to the diversity of the possible answers students can find within social sciences they become uncomfortable with the reporting of the results. Comparing the results or helping each other to understand what different theories predict might not happen due to the large differences in theories they might come up with. Students also have a difficult time dealing with several truths or answers, especially when these solutions contradict each other.
In the course of time the experiences of the students have had their impact on problem based learning within psychology. Educationalists have increasingly become sensitive to student’s worries and have come up with some “solutions”. One of those solutions is to supply students a list of literature references that serve as suggestions for literature study. These suggestions for literature have evolved into two approaches to helping students.

One of the approaches is to provide students with a list of suggested literature that students minimally need to read in order to pass the test. Even though this approach has become common practice and is implemented in different blocks all over the curriculum, it seriously intrudes on the self-directedness and ownership of the learning of the students. Supplying the necessary literature references has a negative effect on formulating learning issues the students feel need further clarification. The learning issues need no longer be specific, there is no longer a "reward" or "punishment" when the learning issues are vague or not appropriate because they already know what needs to be studied. Previously the learning issues were the only help in directing the self-study time, now it has become practically useless because at the end of the day, they will study the prescribed literature and not follow their own thoughts or interests. This has of course a devastating influence on the brainstorm; there is no longer a necessity or need to really get involved in the brainstorm, students no longer need to make themselves vulnerable by possibly saying stupid things or by being too strongly committed to the subject. And it even becomes worse. As noted, supplying the minimal amount of literature references has a negative influence on the self-directedness of the learning, but when the students get together in order to compare the solutions they have found to their learning issues, the articles are discussed instead of the learning issues. The topics that are discussed follow the structure of the article; the problems that the article puts central have become central in this phase, instead of the issues the students themselves might have come up with.

The second approach is to supply students with a list containing far too many literature references for every individual student. Solving the problem this way appears to put the students in control again, because students have to make a choice and therefore have to engage in the discussion to clarify what the problem is about.

However, this approach also runs into a problem, the so-called 'grain problem’. The learning goals are not allowed to have its full potential, this time because the size, structure and content of
the article reduces the ownership of the learner over his/her learning. After the small group discussion, students make a selection of the literature they want to read. Often very simple and understandable selection criteria are used to narrow down the amount of literature to the ones the student wants to read: ease of availability, number of pages, language, appropriateness of title, and face validity of content are but a few of the possible criteria. Selecting an article has not necessarily to do with answering the learning goals, or trying to understand a subject. This is also due to the fact that students have very limited means of judging the appropriateness of the article to their learning goals. Students then go home with the two or three selected articles, and start reading them. The student has committed himself / herself to reading the selected article, and does not allow for all kinds of doubts/questions that are not in the interest of reading the articles. Important questions like "what is the relevancy of what I am reading?", "does this really answer my learning goals" or "how does the information that I am reading relate to other relevant information?" are considered of secondary importance.

A promising solution to these problems is the topic of this paper, and is called Resource Based Learning (RBL). RBL is actually an ill-defined concept, there is no single one definition that catches all the possible different approaches that identify themselves with this approach but they all agree on opposing to principles of "Directed Learning". Direct instruction employs clearly articulated external learning objectives, tends to isolate information, organizes the to-be-learned concepts into the presumed hierarchical nature of knowledge, and aims at producing correct responses. Consistent with learner-centred design principles, Resource Based Learning Environments (RBLEs) emphasize the role of the individual in uniquely assigning relevance and meaning, establishing leaning needs and goals, and engaging in learning activities. They promote divergent thinking and taking multiple perspective rather than a single “correct” perspective. Since these environments encourage personal inquiry, it is unlikely that all individuals will encounter the same information sources, or interpret them consistently. RBLEs support and extend thinking by providing different types of tools, activities and scaffolds without imposing or restricting the content or the sequence of the learning process. It is the learner who continuously has to decide what he or she wishes to read. Some of the promises of RBL include a direct availability of vast amounts of information, no physical or time constraints on disclosing the
information, and full ownership of the learner over the environment. The learner is offered an opportunity to get passed superficial selection criteria because he can now continuously afford to question the relevancy of what he is reading, and drop whatever he is reading for something else that looks more promising to answering his goal. Learning goals are becoming decisive because literature references are no longer supplied.

But RBLEs without support (like the internet), turns information search (a top down, goal directed process) into information discovery (a bottom up-process, guided by face validity of information). And as attractive as information discovery may seem, information discovery in a database with information that is only very loosely linked by threads of casual links or visual fascinating or promising pictures brings with it some very undesirable results. Dependent on the amount of prior knowledge and the goals of the learner, different browsing strategies can be identified. Observing is one of the most applied browsing strategy because it allows for the search of an ill-defined object (both in the RBLE as in the information seeker’s mind) in an unorganised environment. A major drawback of this of this strategy is that it requires intensive use of interpretation and reflection to make sense of what is observed and to relate it to the information seeker’s objectives. So, even though the observing strategy is one of the most chosen strategies by naïve learners, they impose a continuous and high attentional load on the information seeker, and opportunities to get distracted are superfluous. Observable coping strategies against this working memory overload include a focus on detail, a bias towards familiar information, a tendency to follow corroborating rather than contradicting evidence, and floundering around without reflection or inference often producing the illusion of productivity.

So, even though RBL might be an enrichment within the context of PBL, it should be implemented with care. One of the key-questions that should be explored is how naïve learners can best be supported when the intent of the learner is unknown, and many resources have to be allowed that support the construction of meaning for which they had not been created initially? In trying to answer this question, Marchionini’s (1995) information seeking model offer some initial directions.

Marchionini (1995) developed a cognitive psychological model that describes a number different sub-processes that are relevant during information seeking in electronic environments. Marchionini postulated eight different sub-processes, and assumes that the default transitions
from one sub-process to another develops sequentially. The five sub-processes that generate or receive the most important feedback are depicted in figure 1.

![Diagram](Image)

**Figure 1.** Cognitive psychological model of the information seeking process of Marchionini (1995). The five sub-processes that generate or receive the most feedback, the feedback loops, and the default transitions are depicted.

The inclusion of the feedback loops expresses the highly recursive nature of the information seeking process, and thereby illustrates the principal uncertainty of this process for students who are not, or only moderately, familiar in a domain. Students are partly engaged in some degree of advanced planning but are equally involved in continuous, online improvisation in which the documents they encounter to a large extent determine the course of action that is taken (Kirsch, 1997; Lawless & Brown, 1997).

The degree in which the information seeking process deviates from a top-down, sequential order is considered to be indicative for the seeking strategy that is chosen. Dependent on the amount of prior knowledge and the goals of the learner, different browsing strategies can be identified. *Observing* is one of the most applied browsing strategy because it allows for the search of an ill-defined object (both in the external environment as in the information seeker’s mind) in an unorganized environment. *Scanning* involves a continuous comparison between the internal representation of the information object and the information in the environment and is used when the information object is clearly defined in the information seeker’s mind.

Even though the observing and scanning strategies are most frequently applied by novice learners, a major drawback of both strategies is the enormous cognitive effort that is associated with these strategies. Both strategies requires intensive use of interpretation and reflection to make sense of what is observed and to relate it to the information-seeking objectives. Added to that is the potential of an overload of the working memory due to the development of parallel lines of simultaneously evolving subclasses. Observable coping strategies against working memory overload include a focus on details, a bias towards familiar information, a tendency to
follow paths of corroborating rather than contradicting evidence, and floundering around without reflection or inference often producing the illusion of productivity.

Gerjets, Scheiter and Heise (1999) focused on the distraction of the information seeker caused by the emergence of conflicting goals. As Marchionini, they assumed that new and additional goals can arise by cues in the hypertext environment. They showed that participants who were offered two goals simultaneously, performed worse on a problem-solving task than participants who received the goals sequentially. Interestingly, they were also able to show that the influence of the second goal depended on the difficulty of the first goal. When the first goal was relatively easy, subjects spent more time on information that relevant for the second goal and less time on information that was relevant for the first goal. When the first goal was difficult this effect tended to disappear. Regrettably, Gerjets et al turn down possible cognitive psychological explanations for these data. They believe that this paradigm fundamentally falls short since it would only allow for very simple experimental tasks, that need to be presented in an experimentally predefined order. Complex tasks in which the participants determine the order of the tasks are presumed to be outside the scope of possible explanations from cognitive psychological theories. Even a quick glance over the research that is done within this cognitive psychological paradigm proves these researchers wrong. It is also peculiar that Gerjets et al. choose to use a second task that strongly distracts the participants on a motivational or even hormonal level (e.g., guessing the first three winners in a beauty contest between ten women) when they want to describe distraction by conflicting goals in learning in general. Their decision to use a second task that strongly distracts the learners on a motivational level therefore compromises the external validity of their findings. Although the possibility of distraction due to such a strong goal is acknowledged, learning in general surely is not defined by such distracting goals.

The Cognitive Load Theory (Sweller, 1988, 1994; Sweller, van Merriënboer & Paas, 1995) stresses the decisive importance of the limited working-memory capacity in learning and problem solving. For learning or problem solving to occur, the cognitive load imposed on the learner may not be allowed to exceed the capacity of the working memory. When the capacity of the working memory is exceeded, learners are severely restricted in the acquisition or application of relevant
schemata. The Cognitive Load Theory (CLT) has generated several instructional techniques aimed at freeing the learner from resource-demanding operations that are not supportive to the learning or problem solving process. For example, whenever learners are confronted with two information sources (e.g., text and diagram) that need to be mentally integrated before they can be understood or applied, the so-called ‘split-attention’-effect occurs. Attention has to be split between both information sources in order to mentally integrate them. The integration of these information sources misdirects working-memory capacity to processes of searching and matching that are unrelated to learning and problem solving. CLT has been used to predict this ineffectiveness and to enhance its potential by suggesting the physical integration of both information sources. The physically integrated information frees working memory capacity that in turn can be devoted to learning or problem solving.

In this research, the focus will be on novice learners who are trying to find information in an electronic environment that needs to be applied in a problem solving task. Marchionini pointed towards that possible highly recursive nature of the information seeking process, and the possibility of simultaneously evolving lines of sub-processes. It is assumed here that these process descriptions are especially manifest in learners who are not (or only moderately) familiar in the domain in which they are looking for information. Novices tend to start looking for information with ill-defined goals which are soon replaced or complemented by different goals and this is likely to continue until the novice finally knows what he / she is looking for. Gerjets et al. showed that participants pursuing more than one goal simultaneously perform worse than participants who pursue the same goals sequentially when they perceive the goals as easy to attain. CLT seems well equipped to bring together Marchionini’s description of the information seeking process with the general findings of Gerjets et al. while using cognitive tasks.

In a series of experiments, the applicability of the Cognitive Load Theory to learning in interaction with RBLEs will be shown. Starting from the results of these experiments, recommendations will be made for ways in which learners can be supported in their learning.

References


