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ABSTRACT

This paper examines, through historical analysis, the values and beliefs underpinning the early theories and applications of problem-based learning and contrasts these with current theory and practice. This study focuses on the first three decades of the twentieth century, because, during this time period, the use of projects in education became popular, and because this was a period of time when ideas from business and industry began to be used in educational contexts. This analysis puts current practice in a more meaningful context and suggests new options and interpretations for the future application of problem-based learning and teaching strategies. Topics addressed include: (1) the historical backdrop to the use of projects in education, focusing on the work of E.L. Thorndike and John Dewey; (2) what a project is not; (3) early project use in education; (4) various definitions of the project in education, including two basic categories (a manual activity aimed at a pre-specified result, or the basis to establish the entire curriculum); (5) agreements on definition; and (6) current examples of problem-based learning. (MES)

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PROBLEM BASED LEARNING: A HISTORICAL ANALYSIS

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Background

In recent years there has been much interest in the Instructional Design field around the concept of constructivism (e.g. Jonassen 1991, Wilson 1996, Driscoll 1994, Duffy and Cunningham 1996). Problem based teaching and learning strategies are among the most frequently used constructivist design approaches (e.g. West, Farmer, and Wolff 1991, Bednar, Cunningham, Duffy, and Perry 1991, Duffy 1996). Problem-based teaching and learning strategies have been used successful with a variety of learners in a variety of contexts (see Duffy and Cunningham 1996 including business and industry (Dunlap and Gibson 1997), higher education (Harper and Duffy 1997, Duffield and Grabinger 1997), and K-12 settings (Fosnot 1989). Problem-based teaching and learning strategies are becoming well established as a method and an area of study within the field of instructional design.

Problem

An important but overlooked aspect of the study and use of problem-based teaching learning strategies is its history and the philosophical/theoretical implications of those strategies in a broader history. At first this may not appear to be cause for concern. Problem-based learning can be seen as simply an instructional strategy. But there are no value neutral actions in instruction (Yeaman 1990, Kwan and Anglin 1990). Values and the philosophical study of values have existed all through history. Therefore philosophical questions can be analyzed through studying history (Koetting 1996). Studying history can help us to understand why we are the way we are. It can also help us to maintain our traditions, help individuals and members of the field to stick to their roots. But it can also provide us with more options and help us to break out of past patterns if it seems important to do so (Januszewski 1996).

Purpose

The purpose of this paper is to examine, through historical analysis, the values and beliefs underpinning the early theories and applications of what is now called problem-based learning and contrast these with current theory and practice. This study will focus on the first three decades of the twentieth century because during this time period the use of projects in education became popular and because this was a period of time when ideas from business and industry began to used in educational contexts. This analysis will, as Januszewski (1996) suggests put our current practice in a more meaningful context and potentially suggest new options and interpretations for the future application of problem based learning and teaching strategies.

The project

The literature dealing with the field of education in the first three decades of the twentieth century shows that there were many interpretations of the use of the term "project" in the educational context. As one might expect, considerable and critical discussion of the meaning and implications of these conceptions followed.

The following review of this discussion was offered by a graduate student.

> The term project carries a variety of meaning: to some, fad; to some, certain misconceptions involving, for instance, a confusion between process and result, as when a tabourette is itself called a project; to some a sound, but limited method of education needing generous supplementation from other methods, such as drill; and to others, a valid, inclusive method, long in incidental use, but now to be consciously extended. It is not difficult to see in each a share of truth. A history of the movement would real at times a faddish aspect; in its core of meaning it is doubtless very old; it cannot, alone of all theories have escaped misconception; and when conceived as a partial method, it of course needs to be supplemented from without itself. While some disapprove of the use of the term itself, they will perhaps admit that the main trend seems to favor both the term and the practice (Herring, 1921).

The differences among the various conceptions of the project method were both philosophical and applied, or perhaps put another way, both strategic and tactical.

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The historical backdrop to the "project"

There are two individuals, E. L. Thorndike and John Dewey, whose scholarship had a profound influence on those that promoted the use of projects in education as it did many educational issues. Thorndike and Dewey, while they had substantial disagreements, were part of a new emphasis on the scientific method as a mode of inquiry when investigating the subject of teaching. Science and scientific applications would soon stand side by side with philosophy in determining the educational process.

E. L. Thorndike was a prominent psychologist who sought to create a science of education on which all teaching could be based. Thorndike maintained that there were three psychological laws of learning: readiness, exercise and effect. The formulation of these laws were based on his emphasis on learner outcomes, outcomes which could be quantified. Thorndike's other contributions included work with student evaluation, the choice, design and organization of instruction. He was also an early advocate of the investigation of individual differences among learners (Thorndike, 1911, 1913).

John Dewey wrote and commented extensively in all areas education, science, and philosophy. His work was often cited by writers on opposite sides of the same educational issue, the project debate has proven to be no different. this may be due to the fact that it was common place that everyone talked about Dewey and no one read him. Perhaps a more accurate statement would be everybody talked about Dewey but few people understood him.

The citations of the works of Dewey were bound to add credence to almost any academic position. A cynical observer may liken these frequent, but uninformed, citations to trotting out artillery and cannonading the opposing position in an attempt to dislodge their philosophical base of support. But this is a compliment to Dewey. No other figure in educational thought held so much notoriety in the American education community. It can be argued that Dewey has influenced more educators than any other individual of that time period. A giant in a field may attract disciples who in turn interpret the original work into something that was not necessarily the original intent. Dewey's writing style has often left him in a position to be interpreted in a distorted manner (Cremin, 1961).

It is particularly important to be aware of the potential for influence of Thorndike and Dewey on the use of projects in education because they had substantially different perspectives on the role of science in education. Also, attempts to infuse projects into education were done in the name of science.

What A Project Is Not

J. A. Stevenson provides a useful treatment of the project in educational settings. He proposes his own definition of a project. He compares the definitions and uses the term by others up to the time of his writing. The result is a "meta-definition". He comes to his definition through the analysis of common terminology and includes as valid, the use of the term by most of the popular proponents of the project at the time. To be sure not all whose definition he reviewed would agree with the conclusion he draws. They would, for the most part, agree with his determination as to what a project is not. We include a discussion of what is not a project because it will reveal some of the common ground that is held by all proponents of project use in education. This will also provide a point from which we can embark on the explanation of the uses of the term project in education. Stevenson's definition – "A project as a problematic act carried to completion in its natural setting" (Stevenson, 1925). In so defining a project he is able to eliminate the following practices as not being projects: problems, questions, topics, drills, tests, reviews, applications, demonstrations, experiments, and practicums. His elimination of these terms as a substitute for projects is based on the fact that they would all need some qualifying adjective which would change their meaning from the way they were popularly used in that day. The majority of these other methods stressed information over action, the subjugation of problem to a principle, and the inferred emphasis on an artificial rather than natural setting.

Early Project Use in Education

Prior to 1900 the word project had been used for many years in business and in some specialized forms of education, most notably architecture, with a vague meaning. In 1908-1910 the unmodified word project was used by R.W. Simson and David Snedden in their report to the Massachusetts legislature regarding agriculture courses in vocational schools. In approximately the same time period (1908-1910) the term project had begun to be used in professional school programs such as medicine, engineering, and journalism. Soon after the term project was creeping into the vocabulary of educators at all levels. As the use of the word gained in popularity it was inevitable that many uses and definitions of the term would be developed.

Various Definitions of the Project in Education

Some of the proposed definitions of, and explanation of, the use of the word project in education are as follows:

> J. A. Stevenson's definition – "A project is a problematic act carried to completion in its natural setting". Explanation: 1) There is implied in an act carried out to completion a desire for action rather than a "passive absorption" of information; 2) the insistence of a problematic situation demands reasoning over memorization; 3) by emphasizing a problematic aspect there is a priority of problem over principle which infers a discovery rather than an application approach; 4) the natural setting places value on the more life-like environment as opposed to an "artificial" setting (Stevenson, 1925).
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> W. W. Charters definition – "The project is considered to be an act carried to completion in its natural setting and involving the solution of a relatively complex problem. (Charters, 1918). Explanation – "The prime essentials of the project are, that it must involve the solution of a problem and that it must culminate inaction." Other advantages of the project are that ". . .it gives training in locating and solving problems, it gives training in the technique of action, and it teaches subject matter in connection to life situations." (Charters, 1917). There is much agreement between Charters and Stevenson on this issue except for the amount of complexity in the problem to be solved. Stevenson does not share Charter's notion that a project must solve a complex problem.
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> C. W. Stone definition – "A project is a Life Topic in which processes and objects of learning are largely manual." Explanation – Stone defines Life Topics as units of experience that are worthy of value. Stone also places an emphasis on finishing a product. It also seems clear that this limits project use to performing physical or manual work rather than solving a problem (Stone, 1921).
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> D. Snedden definition – ". . .To be an educational project such as a job (e.g. . .wiring a room, growing a half acre of potatoes, etc.,) must be of such a nature as to offer large opportunity, not only for the acquisition of new skill and experience in practical manipulation, but also for applications of old and learning of new related knowledge." (Snedden, 1916). Explanation – the use of the project as outlined by Snedden is also limited. It seems that, like Stone, Snedden considers projects only acts that require manual activities. He has a strong emphasis as objective standards for the judging of the final product of the project. Project use for Snedden requires the building of new knowledge upon older, related knowledge.
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> J. A. Randall definition – "School Project – A problem the solution of which results in the production of some object, or knowledge of such value to the worker as to make the labor involved seem to him worth while." Explanation – Like Charters and Stevenson, Randall sees a project as solving a problem. There is an emphasis on the production of some object, although obtaining knowledge is included in his definition. There is no seen objective standard for outside evaluation discussed by Randall, only that the "worker" involved believes that the activity was worthwhile. The evaluation is performed by the individual learner (Randall, 1915).
>
> W. H. Kilpatrick definition – "Project – A wholehearted purposeful activity proceeding in a social environment." (Kilpatrick, 1918). Explanation – This definition has three features that are thus far unique: 1) that the action be determined by the individual learner; 2) that the act need not necessarily be carried out to its completion; 3) that the act take place in a social setting. Kilpatrick identifies four possible types of project but admits that there may indeed by the possibility of overlap among them. "The first type represents those experiences in which the dominant purpose is to do, to make or to effect." "The second type of project may be defined as one which involves purposeful experiencing or appropriation of an experience." "The third kind of project is one in which the dominating purpose is to solve a problem, to unravel and so compose some intellectual entanglement or difficulty" "The fourth type includes experiences in which the purpose is to acquire some item or degree of knowledge or skill, or more generally, experience in which a person purposes his own education a specific point. (Kilpatrick, 1925). There are three aspects of a project that can be identified: 1) the presence of a purpose (the desire); 2) the activity itself (the doing); and 3) the outcomes of the activity (the result of the doing).
>
> J. F. Hosic Definition – "I understand by project a complete unit of experience. The essential aspects or elements of an experience are, in the simplest form, a situation and a response to it. This, however, will not describe adequately what is meant by the type of experience called complete. Such a unit includes the following phases: situation, problem, purpose, plan, criticism of the plan, execution, judgement of results, appreciation. This is, of course, not a chronological order strictly speaking as a feeling of appreciation will spring up in anticipation of the outcome, while on the other hand, purpose persists and the plan is modified to the very end. (Hosic, 1924). Explanation – Hosic, like Kilpatrick, places an emphasis on the purpose of the project. He uses the terms criticism, judgement, and appreciation to show that a particular project need not be carried to the completion of some object. In his definition, as I have provided it, he enumerates the phases of the project. For Hosic, the purpose of a project can be defined in terms of a problem.

There are a number of definitions, uses, and conceptions of the project in education. Those seem to fall into two basic categories. The first is the uses of projects in the areas of Agriculture, Home Economics, Industrial Arts and Science which view projects as a manual activity which is aimed at a pre-specified result. In performing the activity and obtaining the result it is believed that the "doer" will acquire additional knowledge and/or training from the process. The second are definitions which are very similar to the Kilpatrick/Hosic conception of project, which saw project use as the basis to establish the entire curriculum.

The two positions on project usage in education are part of broader theories on the role of the school and curriculum development, these are the social-efficiency movement in education and child-centered education. The

social-efficiency orientation was demonstrated by the project conception of Charters and Snedden. They hoped to systematically arrange parts of the curriculum into projects in such a way that it fit into their "scientific curriculum building" mold. Kilpatrick and Hosic are considered part of the child-centered approach in their conception and development of project use.

Agreements on Definition

Despite the marked differences between these two camps, there are some similarities. First, both groups agree that when using the project style of teaching the problem or purpose that is to be addressed in the project should be determined before any of the principles or knowledge to be learned are introduced. The introduction of the principles or knowledge prior to the problem changes the activity to an application or practicum, it is no longer a project.

Second, that principles should be developed as they are needed to complete the project. Introduction of principles prior to the project is to eliminate any change from the "organized and systematic treatments" of this subject matter. This would defeat areas of the agreed upon purposes of project usage which is to avoid presenting the learners with dictated information and exercises.

Third, it is agreed by members of both groups that projects will be most successful and will show the highest degree of effectiveness when the learner chooses to take ownership of the project. The project must hold the students' interest to be educative. There does not appear to be a substitute for intrinsic motivation. Members of both groups agree that such a motivation is most desirable and should be capitalized on "whenever possible."

Fourth, one of the great advantages of the project style of instruction is that it most resembles real life. Students will become more involved in project style work because they will be able to see the tangible results of their work. This will in turn encourage more learning through a greater effort. A learning spiral will result as tangible results build on one another.

Fifth, both groups see the use of projects as being an efficient and effective way of promoting student learning. Students will learn how to think, how to do, and how to complete work once begun. A number of desirable skills could be cultivated using projects in education.

Finally, problem based learning could be either individual or group based. It need not be one or the other.

Examples

One of the authors has recently worked on two instructional development assignments that illustrate how modern instructional design strategies have embraced emerging problem centered and constructivist perspectives. In each case, clients actually use the term "problem-based learning" to describe the underlying instructional design approach. Each deals with radically different content and target audiences. One is an initiative in the public school system the other in business and industry. Interestingly, both assignments reflect many of the characteristics of "projects" as summarized above.

The New Brunswick Alcohol Awareness Project got its start in 1997 with a large grant from the Brewers Association of Canada. The Brewers Association designates monies each year to support education and awareness programs in the community around responsible alcohol use. After extensive collaboration with stakeholder groups the Brewers Association decided to ear mark funds for an alcohol awareness program aimed at middle school kids. The effort will result in a set of curriculum materials that supplements the meager offerings currently available around this topic in Canadian Schools. Another important project goal is that the final product leverage communication and computer technology available to kids at home and in their classrooms. The finished curriculum materials will be piloted in the province of New Brunswick and then made available to school boards across the country by late 1999. A group of curriculum specialists, content experts, instructional designers and multimedia specialists has been charged with building an engaging, effective technology based set of curriculum materials.

From the outset , everyone involved felt strongly that technology should not be used to simply deliver alcohol related facts and figures to learners through their classroom computers. Instead, the program developers believed that learners should be engaged through a series of collaborate activities or "projects". Project descriptions (as well as support materials for teachers would reside on a web site. In addition, the web site would contain a rich repository of material related to alcohol use in society. These materials will include graphs showing patterns of alcohol use across different groups, audio clips of people describing the reasons they use alcohol or helping professionals describing their interactions with problem drinkers. Learners would be encouraged to work collaboratively both within the classroom and with learners at other schools. Projects would culminate with an "artifact" of some kind -- a poster or newspaper article -- that would, in turn, be posted to the "gallery" section of the web site. Two other sections of the site will be designed specifically for teachers and parents. The teacher's section will include a variety of strategies around effectively deploying the web resources in the classroom. The parents section will, among other things, provide information about how to discuss alcohol related issues with preteens.

The second example of "problem based-learning" is a technology based learning product for a large national police service. The police service's training efforts have slowly been adopting a problem based focus over

the past five years. This particular project represented the first time the police service's problem based approached would be realized through technology-based, self-study learning materials. The finished product will be used with pre and inservice police officers. The police service wanted a learning product that would challenge officers to reflect on the way they resolved challenging and potentially life threatening situations. Learners would always gain access to foundation content within the context of authentic scenarios.

The prototype, now in development, is constructed around five video scenarios. Each scenario unfolds based on the decisions a learner makes. At each decision point, learners are directed to foundational content that will help them see how their real-life actions are instructed by underlying principles. At the conclusion of each scenario, learners receive feedback on their decisions through the eyes of an expert colleague. This gives the debriefing exercise an enhanced sense of credibility. A collaborative element will also be developed. Learners will have the opportunity to write an actual report based on their handling of the scenario. Reports will be posted to a web site where peers will have an opportunity to comment.

Conclusion

Much of the language of the field of education in the early twentieth century is consistent with the language that is used in the field of instructional technology, instructional design, and constructivism today. Examples include the need for efficiency, the use of objectives, systematic design of the curriculum, the need to manage instruction, individualizing instruction, projects, and problem based learning.

Modern Problem Based Learning evolved out of early conceptions of the project method. Just as there were different conceptions of the project method in education there are different usage's of Problem Based Learning in instruction, both in K-12 settings and in business contexts.

Modern day problem based learning might best be viewed on a continuum where prespecified outcomes determined by instructors/clients to the creation of environment where learners determine their own expectable outcomes. Both of these pole have roots in the project method. In order to effectively make decisions about where on this continuum a problem based intervention should lie, one needs to understand the philosophical underpinnings of the project method at that point on the continuum and one needs to understand ones own philosophical position regarding teaching and learning.

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