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INTEGRATING PERSUASIVE PEDAGOGY IN MATHEMATICS LEARNING AMONG OPEN AND DISTANCE LEARNERS: AN ANALYTICAL VIEW

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ABSTRACT

Persuasive pedagogy allows the educator the opportunity to examine and help the student change the beliefs underlying their implicit knowledge and construct conceptions in a way that is not theoretically possible with constructivism. Evidence pedagogy provides specific instructional practices that are immediately available for implementation in the classroom among open and distance learners. The persuasive teaching practices of discussion, justification, and refutation provide teachers with mechanisms to help students resolve misconception. Since the early 1990s, mathematics education researchers have proposed the use of constructivist practices to counteract these ever-prevalent obstacles. While we do give credit to the choices of instructional activities the constructivist paradigm promotes, there are problems with its use as the foundation of mathematics pedagogy. In this paper, emphasis is laid upon the literature pertaining to the conceptual tenets and operational practices of constructivism, and the viability of these practices for meeting the professional teaching standards proposed by the National Curriculum Framework (2005). This paper also focuses upon the paradigms of teaching that may be more applicable, that of persuasive pedagogical practices, and the ways in which these practices can differentially meet the goals of the mathematics standards. The differences between constructivism and persuasive pedagogy lead us to believe that the adoption of the theory of teaching as persuasion, or persuasive pedagogy, may be more appropriate for learning mathematics and the identification and correction of misconceptions. Further, these pedagogical practices correspond with suggestions for mathematical discourse provided by NCF(2005).

Key words: Persuasive pedagogy, Mathematics education and Mathematics pedagogy.

INTRODUCTION:

In mathematics education, many researchers propose to increase student learning through teaching using methods that appear, on the surface, to align with the framework of radical constructivism. This perspective states that each student should be led through a series of mathematical experiences in order to construct a personal representation of mathematics and how it works. The adoption of constructivism as the theoretical underpinning for learning and pedagogy in mathematics classes provides no mechanism for teachers to explicitly acknowledge and correct the implicit beliefs held by individuals about the knowledge they have gained and that they are trying to learn, in the way that they are defined by conceptual change researchers. Changes in beliefs are deeply entwined with changes in knowledge. Very often, individuals who are learning new information hold onto entrenched beliefs that arise from incorrect information or perceptions. They create what are known as misconceptions by changing their mental models via accommodation (Piaget 1955) or radical restructuring (Rumelhart 1980) in such a way that they erroneously reconcile these entrenched naïve beliefs with new information.

In other words, mathematics educators must subscribe to a theoretical framework that allows them to craft a message in such a way that the characteristics of that message confront students' naïve theories. Because constructivism is constrained by the social and physical environment (von Glasersfeld 1990), students may not construct knowledge that is accepted as correct, leading to inappropriate knowledge constructions that do not fit with what is accepted by the mathematics community (Lerman 1996). Teachers may not be effective in changing the underlying beliefs students hold if they rely on students' abilities to use their own logic to construct responses as advocated by the constructivist paradigm.

In response to the constructivist paradigm, offered mainly as a post-epistemological explanation of conceptual development based upon a separation from objective truth and reality, it is suggested that mathematics educators adhere instead to a theoretical framework referred to as persuasive pedagogy. This theoretical framework details the teaching of mathematics for learning and comprehension in a way that more closely matches the pedagogy being used by innovative and effective mathematics teachers. The theoretical framework of persuasive pedagogy facilitates learning experiences that promote problem solving, reasoning and proof, communication, links to prior knowledge, and multiple representations of the information mathematics educators often use in their classroom teaching. By integrating problem solving experiences, educators can stimulate further mathematical application and learning. By requiring reasoning and proof to justify beliefs, students have the opportunity to develop and evaluate

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conjectures about mathematics. Persuasion forces the students to connect with prior knowledge and create multiple representations that not only strengthens the learning experiences, but also increase retention and application. This type of pedagogy has been shown to be effective in other content areas.

One reason persuasive pedagogy has value in the mathematics classroom is that the practices of justification, argumentation, and discussion are fundamental aspects of this teaching pedagogy that not only confront student misconceptions, but also student beliefs about knowledge. This is important because merely addressing misconceptions does not modify the underlying beliefs that are used in constructing meaning. Teachers who incorporate persuasive practices into their teaching may find themselves and their students better equipped to handle the misconceptions that are common in the learning of mathematics. In other proposed and implemented teaching theories such as constructivism, methods for correcting misconceptions are not as explicit and direct, thus making them less effective.

PERSUASIVE PEDAGOGY AMONG OPEN AND DISTANCE LEARNERS:

Due to the uncertainty and individualistic perspectives and underlying beliefs of students about knowledge inherent in constructivist teaching, we propose that a viable solution to the problems in current math education is in the model of persuasive pedagogy. Persuasive pedagogy is a paradigm of teaching that, like social constructivism, sees learning as a process of shared understanding. Learning is not just a transmission of information, but a dialog between student and teacher to come to a common understanding of the topic at hand (Murphy 2001). The way that persuasive pedagogy differs from constructivism is in its conceptualization of student roles and their prior knowledge.

In the teaching as persuasion paradigm (Murphy 2001), students and teachers acknowledge that there is often no one correct view in complex problems and that multiple perspectives are worthy of investigation. It is imperative that mathematics teachers use instructional techniques in these discussions that facilitate student explanations; conceptual understanding can only come through discussion when those teaching techniques comprising persuasive pedagogy are used. A learning

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classroom context can be a fruitful breeding ground for conceptual understanding when it gives students the opportunity to verbally express their conceptions and explanations, to compare, question, criticize, evaluate them, as well as to write in support of thinking, reasoning, and communicating about knowledge construction. If students do not have the opportunity to uncover their misconceptions through critical reasoning and evaluation of different claims, they will not be able to overcome them.

PRACTICES OF PERSUASIVE PEDAGOGY IN THE MATHEMATICS AMONG OPEN AND DISTANCE LEARNERS:

Using persuasive practices in a mathematics classroom is different from, and may be somewhat easier than using constructivist practices because there exists a set of well-defined practices encompassing teaching. The hallmark of these is the recognition of and recreation of the interplay of the message and the receiver of the message. This interplay can be recreated in the classroom by discussion. Discussion should start with an honest appraisal of what is known and believed about the subject. This eliminates the need to infer or guess student knowledge and get straight to the instructional strategies. The types of instructional techniques identified by Mason (1998) have been used extensively in research and literature pertaining to discussions about text. For students to be proficient in their thinking, they should evaluate reasons that support multiple conclusions, seek and provide clarification about their own and each other's thinking, and return to the text to settle disputes. In other words, students need to provide some sort of evidence for what they are saying. They might not be able to do these things on their own, instead requiring a group to accomplish the tasks of in-depth learning.

Discussion is important for this because among open and distance learners student learning is improved when causality is explicit. Through the use of "interactive argumentation" during a discussion, causal arguments give discussion more organization. This is especially important when we consider that student discussions can sometimes be vague because students do not necessarily say everything they are thinking. Instead, it was found that students might be inclined to say only enough necessary to get their message across.

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While these vague discussions can be helpful in increasing student understanding, the mere fact that students do not spontaneously make their reasoning explicit can lead to student misconceptions. Teachers must be aware of this and endeavor to become a coach during discussions. They need to teach students how to rely upon observations and facts in making a decision and provide students with ideas for claims they have not considered. Teachers must encourage students to provide evidence for all the claims they make based upon prior knowledge and the instructional materials they are using. They must also encourage students to make their assumptions and thoughts explicit, and model the reasoning process by providing evidence for their own claims.

When teachers model their thinking process through discussion and use of evidence in mathematics classrooms and require their students to do the same, misconceptions may be exposed in the same way they are in discussions about text. Students in mathematics often develop their conceptions based upon inaccurate information or information that is incomplete. This uncovering of misconceptions and incomplete understandings through the use of discussion can help students clear up their misunderstandings.

This type of discussion in a mathematics classroom is persuasive in nature because it encourages students to back up their claims with evidence and requires others to judge between claims on the basis of the evidence provided. When students are required to provide evidence for their claims, the discussion will move from a more constructivist approach called “explanatory inquiry” into what they termed as “critical discussion.” In explanatory inquiry, students are trying to obtain correct knowledge through discussion with their peers, who may or may not have conceptual understandings. By moving discussion into a critical phase using persuasive practices, students can examine evidence that is provided in order to understand divergent viewpoints. Teachers must facilitate the use of divergent viewpoints and evidence for knowledge gain through persuasive practices (Alexander et al. 2002; Mason 1998; Murphy 2001) so that students can determine “why” math works the way it does.

Student prior knowledge and beliefs are essential to the teaching–learning process. Experienced teachers will quickly admit that students are not blank slates, but instead enter the classroom with preconceived notions and perceptions of the world as well as learning from previous lessons. Much of this prior knowledge conflicts with what is currently being taught because of earlier misconceptions.

Persuasive pedagogy is a method of teaching that fosters critical thinking by helping among open and distance learners weigh alternative perspectives, some of those perspectives being their own. It assumes that the student and teacher will both have some understanding of the day's topic, and that only by discussing these understandings will the appropriate and desired learning take place. Persuasive pedagogy starts with the statement of student beliefs and knowledge about a topic. Then the teacher, through the methods of argumentation and justification, will interact with the students to help them understand why the students' beliefs are right or wrong. Both the students and the teacher participate in the discussion of what is "correct" and why. By telling and proving the veracity of the teacher's message, it is assumed the student will not only remember the information for the test, but also most likely remember it forever.

"Teaching as Persuasion" is a relatively new metaphor to describe the most effective practices employed in the act of teaching. This metaphor was developed from the social psychology and persuasive text literatures. Murphy (2001) argued that teachers should take characteristics of the learners and the message, as well as the context of the learning situation, into account when teaching. This must be done, in her view, because learners are diverse and have diverse beliefs about the content at hand. Since teachers must also make sure that students acquire and accept knowledge as correct that is accepted by the scientific community at large, teachers must use instructional methods allowing students the opportunity to change both their knowledge and beliefs concurrently. By teaching using the more positive tenets of persuasion, teachers will be able to help students change their knowledge and beliefs.

Persuasive pedagogy not only expects students to know about and have experiences with the topic, it actively expects that most of that information will be unexamined and perhaps even incorrect. Using persuasive pedagogical practices requires teachers to create activities in which prior knowledge is both recalled and examined in the learning process. This view of prior knowledge assumes that when the lesson on dividing fractions starts, not only have students

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learned what a fraction is, but that they have also had experiences in which they have had to divide fractions. This experience should be brought to light in the classroom when dividing fractions is discussed and taught.

MISCONCEPTIONS IN PERSUASIVE PEDAGOGY:

Unlike what is found in constructivist teaching, persuasive pedagogy considers the problem of misconceptions directly. Persuasive pedagogy calls for students to not simply acquire knowledge, but revise existing conceptions and beliefs through deep interaction with content. This is not directly possible with constructivist teaching because teachers are only able to infer student knowledge and plan experiences according to these inferences, which may initially be wrong. In contrast, persuasive pedagogy is a theory of teaching that builds on what is known about changing people's opinions through persuasive texts and conceptual change . Past research on persuasive texts informs us that in order to be persuasive, the reader must find the information interesting, personally relevant, and intelligible (Petty and Cacioppo,1986). These same features, plus plausibility and better explanatory power, are necessary if a student is expected to discard prior conceptions in order to accept new ones.

Often, math misconceptions seem to be the result of mistaken teaching practices. This is not to say that the math is taught incorrectly; instead, many math procedures are taught with an inadequate or missing conceptual grounding, requiring students to form their own understanding about the underlying concepts and do their own sense-making. Many of these student-created conceptualizations seem sufficient as the student correctly performs the procedure and passes the test. Yet when the concept is used in future mathematics, often the student-formed conceptions may not be appropriately developed, have integrated extraneous details as assumptions, or have missed crucial elements.

Because math is incremental and each new concept builds on something learned previously, math teachers depend on students having prior knowledge in order to combine their previous conceptions with new factors that allows for a more general conceptual understanding. For example, when teaching addition and subtraction of decimals, teachers do not want students to replace all they know about adding and subtracting whole numbers with concepts about adding decimals, but instead to merge the two sets of understanding into a larger concept.

Studies of conceptual change often suggest that creating situations of cognitive conflict should help students realize that their previous conceptions are insufficient, and aid in resolving these misconceptions. Yet, many students still fail to resolve these misconceptions. In mathematics, this failure seems to stem from two sources. First, students may not notice that their conceptual understanding is insufficient for the task and proceed forward anyway. A second problem may be overconfidence in their prior knowledge. Their confidence in the validity of their previous ideas is such that though students recognize inconsistencies in their knowledge they choose to retain their prior understandings rather than resolving the inconsistencies.

Moschkovich (1999) makes an important point for math educators. That is, once a certain level of domain knowledge is acquired, the concept and its underlying assumptions become familiar knowledge. Often, some of the assumptions are tacit. Teachers fail to mention these assumptions because they forget that novices do not understand them. Students though, do not know these assumptions and try to create understandings of the assumptions. As indicated earlier, they may treat what is an extraneous detail as a salient feature of the problem and in trying to construct meaning may lead themselves into misconceptions. Since these misconceptions are developed by the student in a sense-making exercise, the conception is much harder to root out when (and if) it is later exposed.

By teaching in a purely constructivist way, misconceptions in mathematics may be strengthened because instead of being discovered and corrected, they are accepted as students' understandings, and then new conceptions are built upon them. Constructivists do not consider the epistemological conditions of whether knowledge is justified or whether those constructed conceptions are even true. However, this is not the way mathematics should be taught. While the fact that students take positions and construct their conceptions might work well for more ill structured domains, in mathematics, there is an accepted answer. The use of constructivism in mathematics is not for students to come up with an accepted answer to a given problem by their

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own means, but rather for them to come up with their own answer. Thus, the misconceptions upon which their answers are based may not be discovered.

Persuasive pedagogy not only makes allowances for students to enter the situation with prior knowledge about the topic, it expects it, and finds it essential to the lesson. This is not just in the idea that students have learned what a fraction is, so they are prepared to learn division of fractions, but this is that students have had experiences in which they have had to divide fractions, and that experience should be brought to bear in the classroom as justification when dividing fractions is discussed and taught.

CONCLUSION:

Good mathematics instruction needs the practices promoted by constructivism, such as active experiences with learning, teachers who consider students' capacity while planning lessons, and discussion of mathematical ideas through problem solving. It is vital to convince teachers holding constructivist perspectives that students develop their own understanding through interaction with the concepts. However, there remain some problems in promoting the theoretical framework of constructivism in the classroom.

The first problem comes in the lack of specific practices. Constructivists state that students' mental processes and learning are accentuated by reflecting on their deliberate activities. Yet, this learning is not replicable because constructivists do not tell us what those deliberate activities actually are. This lack of structure and repeatability could imply that learning rarely occurs. However, it has been recognized that students can learn in well-structured domains, such as science, if specific teaching practices are identified. Not providing these specific practices implies that to implement constructivism, teachers will find the time to construct their understanding of constructivism and then develop corresponding practices. Without significant changes in the way that schools are run, including provided time to prepare and deeper, more sustained, professional development experiences, the majority of teachers would not be able to accomplish this.

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The other problem is the tenet of a lack of an objective reality. Math is built on accepted ideas that are agreed upon as evidence of an objective reality. If students do not understand these ideas, they should be explained and overcome. Yet theoretically, a constructivist teacher cannot label a student's answer as wrong, but only as maladaptive, or an alternate conception. Because constructivist teaching does not accept the notion of an objective reality that can be known it weakens the instructor's ability to directly confront the misconception. As long as a student finds use for a maladaptive conception, it must be treated as viable. The most essential part of using persuasion in teaching is having students interact with the topic. In mathematics, this interaction takes place in a process of doing mathematics. Students should have experiences solving problems and developing algorithms for solution. In creating and comparing algorithms in terms of correctness and generalizability, students are placed in a position where they, by examining evidence, discussing alternate views, and providing justification, will hopefully come to a more complete, more correct understanding of mathematics.

Thus, it appears that the use of the current constructivist theory in mathematics education does not prepare students sufficiently for the mathematics that they are being asked to do (Lerman 1996). While the principles of constructivism have value in education, we propose that a reevaluation of the beliefs and principles that underlie instructional strategies is necessary to keep up with the demands of the field. As our understanding of mathematics and learning progresses, it is necessary that our methods of teaching evolve.

Persuasive pedagogy practices are valid for mathematics instruction. Persuasive strategies, practiced by those who ascribe to the constructivist field, yet recognize the regulations and objectivity inherent in mathematics education. Adopting a theoretical framework of persuasive pedagogy allows the educator the opportunity to examine and help the student change the beliefs underlying their implicit knowledge and construct conceptions in a way that is not theoretically possible with constructivism. Evidence pedagogy provides specific instructional practices that are immediately available for implementation in the classroom. The persuasive teaching practices of discussion, justification, and refutation provide teachers with mechanisms to help students resolve misconceptions. Students are required to justify their answers by providing correct reasons as to why they think what they think, as well as why they employed the procedures they used. Refutation, or providing evidence counter to an incorrect position in support of an opposite position, is also essential to persuasive pedagogical practices to help students overcome misconceptions and to provide students with critical thinking skills.

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