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May, 2011

Implementing Interdisciplinary Education at the High School Level

Descriptive Context

In *Waiting for Superman*, the recent documentary about contemporary education, the filmmakers' basic premise is that our 21st century needs for education have surpassed an outdated system institutionalized in the 1950s. The film exposes many roadblocks in our education system, one of which is the inability or unwillingness on the part of some educators to engage students in the highest levels of academic rigor that students require to be successful citizens in the 21st century.

In an effort to conceptualize 21st century learning, Allison Zmuda states that it is the fundamental shift from a teacher-centered learning environment to a student-centered one. Most prominent 21st century skills include critical thinking, problem solving, collaboration, effective communication, and global literacy. These skills require students to actively construct meaning, to distinguish what is relevant, to be deliberate in communication, to share responsibility in learning, and to be connected to a curriculum that connects to their real world (Zmuda, 2009). In essence, 21st century learning focuses on what students can do with knowledge, rather than measuring what units of knowledge they possess.

Critical attributes of 21st century education include integrated and interdisciplinary curriculum planning, technologies and multimedia, global classrooms, project-based research, student-centered learning, and relevant and rigorous instruction (Shaw, 2009). The concept of school, teacher, and learner must change. School will go from buildings with small boxes to nerve centers where walls have a "transparency" that fosters a community of learners. Teachers move from dispensers of knowledge to orchestrators of learning who help students turn information into knowledge, and knowledge into wisdom. Learners are participants in their own learning process who set goals about their own learning, collaborate with all participants, and are reflective in all their processes. Learners are also the new generation of "digital natives" who process much of their world through technological devices, but this does not mean that students are media literate. A 21st century curriculum should have an element of media literacy, along with an interdisciplinary thematic and research-based approach to content and skills filtered through inquiry and problem-based learning (PBL). Lastly, 21st century schools need to shift to a global classroom in which the world is literally at students' fingertips.

Students who drop out or check out do so because they do not see a connection between curriculum, school, and their lives. They also report feeling alienated by an

impersonal system where no one really cares about them. Over half of these students are disadvantaged minorities of color. Schools are responding by creating smaller learning communities and academies that focus on a team approach to teaching an interdisciplinary curriculum. This learning community is fertile ground for school reform and for PBL in particular. In our changing world of education, PBL take on a greater importance in that it allows students to extend their strengths and to explore their interests. There are seven major attributes of PBL. One, issues, themes, and problems form the core of PBL and require in-depth exploration. There are no quick and easy answers or definite solutions. Two, students develop ownership in that they are involved in selecting topics, set their own goals, and take charge of their own learning. Three, instructors take on the roles of facilitators and coaches. Four, students use essential tools including technology, for accessing, retrieving, and producing information. Five, students collaborate with peers and adults. Six, students reflect continuously as they work through projects. Lastly, PBL culminates in a product that presents possible solutions to a problem, analyzes a dilemma from multiple perspectives, or develops an idea in original and thoughtful ways. PBL has the following benefits: It merges thinking and knowledge by helping students master both content and process; it emphasizes real-world skills; it integrates disciplines; it capitalizes on concerns valued in the community; and, it meets the needs of learners with a range of learning styles and needs. Most PBL models are implemented in an interdisciplinary framework in which teams of teachers from different core disciplines plan units that are both true to their content knowledge yet connect through themes, inquiry, and PBL (Harada, Kirio, & Yamamoto, 2008).

Historical Background

In the 1990s medical science began proving what educational theorists have believed for the last 100 years, that learning happens within the context of other learning. In the early 20th century John Dewey believed in an education in which inquiry was central and learning is situated in a process of student engagement that unlocks prior knowledge and makes connections between other learning experiences. Fast forward to the 21st century where advances in medical science such as PET scans and CAT scans can physiologically prove what Dewey and his contemporaries only theorized. Pictures of the brain show the brain as a connector of information. It is physiologically designed to make meaning by making multiple connections that are anything but linear. In the late 1990s, researchers such as Erik Jensen placed this connection on the educational forefront with his *Teaching with the Brain in Mind*. Jensen (1998) states in his opening paragraph that, “We are on the verge of a revolution: the application of important new brain research to teaching and learning. This revolution will change school start times, discipline policies, classroom environments, use of technology, and even the way we think of the arts and physical education” (p.1).

As we began to understand more about the brain and its function in learning, curriculum designers responded by designing curriculum and instruction with the brain in mind. Grant Wiggins and Jay McTighe broke ground with their backwards design concept in *Understanding by Design*. The basic premise of this model is that we start with the end in mind when designing units and lessons. Their curriculum model begins

with identifying enduring understandings, which are the overarching concepts we wish the students to understand, even when the details may be forgotten. Essential questions are developed that will lead students on a discovery path towards the enduring understandings. Broad concepts are identified next, and last is the broad brush detail. Once the conceptual unit model is designed, assessments are created. The last unit pieces to design are the actual lessons that lead to the concepts, assessments, essential questions and enduring understandings (Wiggins and McTighe, 1998).

Heidi Hayes Jacobs (1989) elevated such brain-friendly curriculum and instruction models to the school organizational level. She began asking the question of how we should change the grouping of students and the context of the content disciplines in a way to maximize learning into the 21st century. The interdisciplinary approach to curriculum and instruction is based on the premise that academic subjects are studied with intentional connections to each other through overarching content and skills. While there have been several movements for interdisciplinary models throughout the years, the current 21st century learning model is based in inquiry and PBL. The model challenges educators to rethink their approach to teaming in which the traditional content area teams are replaced by multi-disciplinary teams that design learning experiences based on broad concepts that encompass several disciplines.

Differing Perspectives

Reasons for Implementation

Heidi Hayes Jacob (1989) states that the advantage of interdisciplinary curriculum design is that it “fosters a comprehensive epistemological experience that is stimulating and motivating for students and teachers. There is an advantage as teachers can plan their interdisciplinary work around themes and issues that emerge from their on-going curriculum...units can be flexibly designed to fit time constraints” (p. 17). She point to three key reasons for implementing interdisciplinary models in schools: One, while the school day has stayed the same, knowledge has grown. We must be creative with how we use time to keep learning constant; Two, students are dropping out of school at alarming rates- not physically dropping out, but mentally. They do not view the curriculum as relevant to their lives. We must move to a model that helps kids make connections across school subjects; Three, it is just common sense. Where else in our daily lives or work lives do we exist with information and knowledge in isolation of all other knowledge? We make connections all of the time outside of school. Why would we not capitalize on this natural brain function in school? (Brandt, 1993)

The program directors from the Consortium for Policy Research in Education believe that technological and economic changes are requiring high schools to accomplish something they have never been required to do- ensure that all students achieve at high levels of academic rigor (Cocoran and Silander, 2009). The linchpin to requiring high schools to improve their effectiveness is to improve what is at the core of teaching- instruction. We must move from a model of isolated and independent content area instruction to one in which teachers are guided by a shared vision and goals. In

essence, learning experiences need to have a level of orchestration which includes teacher collaboration through teaming, interdisciplinary teaching, and professional learning communities. The researchers admit that there is limited evidence that these reforms improve instruction and learning, but they urge researchers to continue examining whether these reforms support sustained efforts to improve instruction and learning. While many models exist under the umbrella of interdisciplinary instruction- and there are a myriad of components such as cooperative learning, PBLs, inquiry, adaptive instruction, and dialogic teaching- one element that is common is the emphasis on student-centered learning. This “adaptive instruction” has the greatest potential for success in today’s standards-based environment with its twin values of equity and excellence.

Almost all current research on the 21st century learning movement mentions the need for interdisciplinary learning. Globalization in learning is an important process in preparing students for exponentially increasing globalization of their world. The “digital natives” are the new generation of school children who navigate their world with computers, cell phones, iPods, and the next technological trend on the horizon. They live in a world that is already interconnected, and interdisciplinary education fits naturally in this digital age. While most interdisciplinary programs are at the elementary and middle school levels, some education pioneers are beginning to forge the barriers that have kept such teaming from the high school level. There is a great need for interdisciplinary programs to exist in high school where students are being prepared to successfully negotiate the 21st century world as an adult.

Issues Associated with Implementation

Interdisciplinary proponents believe that enduring learning occurs when connections are made across disciplines. They focus on learning as a whole and not their individual content that students must master on a standardized test. Unfortunately, our hyperfocus in education on the importance of standardized testing presents a convenient roadblock for some educational policy makers. There are those who believe that the “Back to Basics” movement, exemplified by federal policy such as No Child Left Behind and reliance on standardized testing are incompatible with interdisciplinary teaming and 21st century learning skills, especially at the high school level. Critics decry summative attention to 21st Century Skills as a distraction from the more important work of teaching core content. Moreover, these more complex skills cannot be measured in reliable, cost-effective, or scalable ways (Silva, 2009). Proponents have a tough argument as there are few high school models attempting interdisciplinary teaming, so challenges such as master scheduling and the organization of teams can seem too large to tackle. Many districts have a common curriculum that may not allow for the kind of flexibility needed in an interdisciplinary setting. The paradigm shift necessary for 21st century leaning and interdisciplinary teaming can be too great for some teachers. The Washington D.C.-based group Common Core believes that the core curricula of liberal arts and sciences should be the basis of education. “Without a firm base in history, language, and cultural studies, all the fastest high-speed Internet access in the world won’t mean clear global

communication” (Taylor, 2010, p. 8). Common Core also raises concern that the 21st century skills movement is motivated more by economists and the business world.

Even pioneers in the field of interdisciplinary education acknowledge that there are issues and disadvantages inherent in implantation. Heidi Hayes Jacobs (1989) admits “this model requires effort and change... time for planning and energy on the part of the planners. Funds are needed to support best practices and long-range planning. Parents may have difficulty in accepting the value of an interdisciplinary program, because few have experienced the approach in their own schooling. More time is needed to educate the community about this option” (p.17).

Perhaps the biggest disadvantage is the great paradigm shift necessary on at both the organizational and instructional levels. The time, money, professional development, scheduling, and personnel necessary can be overwhelming at a district or campus level. A shift in instruction is needed at the classroom level, and many teachers do not have the training, tools, or desire to step out of their isolated content box. Jacobs suggests to begin with volunteer pilot programs in which both the campus and teachers involved in the interdisciplinary team do so voluntarily and then eventually become the coaches who bring others along (Brandt, 1993).

Snapshot of Research

A case study by Applebee, Adler, and Flihan is often cited in papers on interdisciplinary education. This case study examined the curricula and teaching practices of thirty seventh- through eleventh-grade teachers serving on eleven interdisciplinary teams in New York and California. The study found that their interdisciplinary efforts fell into several categories along a continuum: correlated curricula in which the two disciplines followed parallel lines chronologically or by region; shared curricula in which major concepts were taught across disciplines; and reconstructed curricula in which understanding and concepts were merged across disciplines. The findings suggest that organizing instruction by integrating across disciplines does not necessarily result in systemic change to instruction. Barriers to interdisciplinary instruction included the extra time and effort required of teachers as well as conflicting beliefs across disciplines about subject matter and the ways in which subject matter should be taught. The barriers must be weighed with the benefits. Teachers report growth in teacher efficacy, benefits from teaming, and pedagogical knowledge that results from being part of a professional learning community. They also reported stronger relationships with students that are built through discussing individual student needs as a team and a classroom environment that is supportive and open as a result of the teaming model (Applebee, Adler, and Flihan, 2007).

One 21st learning concern for the U.S. is producing a competitive workforce in science, technology, engineering, and math (STEM). Recent literature has shown that the best approach to building interest in STEM programs relies on inclusive, inquiry-based science, emphasizes PBLs, group work, active learning-based teaching, and incorporating visual demonstration. Researchers from the University of Akron studied the school

district's Bridge Program, which is an interdisciplinary STEM model. A study of former student in the program reported that 100% attended college, and 86% majored in a STEM discipline. The researchers admit that a major limitation to the study is a lack of quantifiable data (Jiang, 2003).

Pamela Aschbacher is a Project Director at UCLA's Center for the Study of Evaluation and the National Center for Research and Evaluation. She has studied the Humanitas program in the Los Angeles Unified School district, which is described as a "caring community of scholars" organized around a thematic interdisciplinary curriculum whose two goals are professional growth for teachers and enriched humanities education for students (Aschbacher, 1991). Humanitas attempts to provide average students with opportunities to develop critical thinking, writing, and discussion skills, and give them a sense of ownership in the learning process. How do they bring interdisciplinary education to the high school where scheduling, sheer size and numbers, and subject matter specialization produce roadblocks? The model creates a voluntary "community of scholars" where teams develop a tightly knit set of courses that typically include English, social studies and art, but some teams include philosophy, math, and science. The courses are organized around conceptual themes such as Women, Race, Social Protest and the Protestant Ethic, and the Spirit of Capitalism. Teacher collaboration is key, and teachers have a great deal of freedom in curriculum design and instruction. Team members have a common planning time. Longitudinal and regression analyses show that students in the Humanitas program have better attendance, score higher on standardized content knowledge tests, statistically improved their writing skills, and improved their conceptual understanding. In a district that has high dropout rates, only 11% of Humanitas students dropped out of school. Teachers in the program assign high-level work, expect more from students, and require more complex thought in class discussions and essays, yet Humanitas students report they like school better than their peers. Teachers also report growth and renewed job satisfaction.

The Issue in Practice

There is a great deal of interdisciplinary integration that occurs at the elementary and middle school levels, where there are a small number of common courses and few or no levels within a course. High schools are just beginning to break ground on incorporating such models at their level. As mentioned previously, scheduling at the campus level tends to be the largest hurdle. There are multiple courses offered at the high school level, and some course may have four levels within them such as resource level, regular, honors, and advanced placement. The most common teaming model at the high school level is to team only the basic core subjects of English, math, social studies, and science. Each team has a teacher from each discipline, and ideally, each team should have a common group of students, but this becomes tricky in practice since one student may be a regular math student, but an honors or above, history student.

In one research-based study on the concept of 21st century learning built around interdisciplinary teaming, Crawford details the implementation of 21st learning skills at Hocking College, a public technical college located in rural Southeastern Ohio.

Professors meet and plan skills that freshmen will need throughout college and beyond. Hocking sought to implement a set of common Success Skills for all students that included communicating effectively, demonstrating math skills, demonstrating learning and critical thinking skills, maintaining professional skills and attitudes, practicing human reactions skills, demonstrating knowledge of science and the environment, demonstrating community, cultural and global awareness, and maintaining a code of ethics (Crawford, 2003).

Related Issues

Student and teacher efficacy are all central to implementing an interdisciplinary model. Albert Bandura is the leading educational theorist on self-efficacy as it applies to both students and teachers. Bandura (1997) defines self-efficacy as “beliefs in one’s capabilities to organize and execute the courses of action required to produce given attainments” (p. 2). According to Bandura, self-efficacy beliefs are constructed from four main sources of information: enactive mastery experiences that are indicators of capability; vicarious experiences that alter efficacy beliefs through modeling and interaction with other; verbal persuasion that indicates to people that they possess certain capabilities; and psychological and affective states from which people judge their capability, strength, and vulnerability to failure. Teacher efficacy influences behavior through cognitive processes (especially goal setting), motivational processes (especially attributions for success or failure), affective processes (especially control of negative feelings), and selections processes (Bandura, 1993). Teachers who believe they will be successful set high goals for themselves, and their students work diligently to attain those goals... These teachers persist through obstacles more than teachers who are not confident in their success. Individuals who believe they will fail avoid expending effort because failure after trying hard has a negative impact on self-esteem. In Bandura’s social cognition theory (Bandura, 1997), teacher efficacy develops through reflection on sources of efficacy information. The most important sources are master experiences, which are situations in which teachers demonstrate their own capability to themselves and reflect upon themselves as competent instructors. The belief is that teachers with high self-efficacy will be more willing to implement interdisciplinary models in their classrooms, and that both teachers and students will grow in their self-efficacy as part of a team.

Schools in England have been encouraged to “personalize” the curriculum and to consult students about researching and learning through student subject choice and integrated curriculum at the middle school level (Thomson and Gunter, 2006). The components of this personalization are using data and relationships to assess the strengths and weaknesses of individual students and a radical approach to school organization based on integrated curriculum teams. Students are viewed as researchers in the process, and actually help design integrated units through inquiry and PBL activities. In essence, they are consultants in their own learning process. Central to this ideology is integrated teams in which students learn as part of a team that has common core subject teachers. The researchers worked with a small group of students from one such school and designed a Likert scale measure about their perceptions of their school and academic

team. Students rated a feeling of being safe at school, relationships with teachers, and deeper understanding of content through integrated connections as particularly high.

Other issues that should be studied are professional development and teaming. The components to interdisciplinary education are many, and professional development should focus on areas such as PBL, inquiry training, cooperative learning, and implementation of technology. The foundation for any interdisciplinary approach is the organization of teachers into multi-discipline academic teams. Campus administrators need to be aware of organizational teaming, types of academic teams, and team-building to effectively develop academic teams.

Recommendations

For School Districts

School districts need to provide training on the various elements of 21st century learning such as problem-based learning, inquiry training, technology implementation, and interdisciplinary teaming. District administrators must also allow for flexibility within the curriculum that translates to flexibility available for planning at the campus level. For example, a district list of literature pieces needs to allow for choice and flexibility of order taught so that *Julius Caesar* can be read while history students are studying ancient Rome, or *The Jungle* coincides with the Industrial Revolution. Districts must also be willing to budget for the necessary technology, training, and resources needed for a 21st century interdisciplinary classroom.

For Campus Administrators

Campus leaders need to create flexible scheduling that allows for interdisciplinary teaming and teacher collaboration time so that integration is intentional. Administrators must also create a school culture of an expectation of 21st century learning. Professional development should focus on teaming, PBLs, and technology. They should also identify the strong campus leaders who have willingness and knowledge to help implement a new model so that interdisciplinary process will have a feel of collective teacher ownership and not just another initiative imposed from administrators.

For Teachers

Interdisciplinary connections are easier to identify in a backwards design planning model such as the process outlined in *Understanding by Design*. Teachers are encouraged to implement such a model in their unit planning as it forces a scope beyond basic content knowledge through the use of enduring understandings and essential questions, and through planning various assessment first and lessons last. Teachers need to engage in professional development on PBL and inquiry based learning, and be willing to take risk in their classroom in the implementation of such instructional practice. For some teachers, a paradigm shift from a teacher-centered classroom to a student-centered classroom is also necessary.

Summary

Educational forefathers such as John Dewey were proponents of connected learning. Our brains are designed to make meaning through making connections, and medical science has proven such in the 21st century. Educators must capitalize on how students learn, and interdisciplinary education is a model that helps students make connections in their learning, thus making learning more relevant. While such models have been implemented and studied more at the lower grade levels, high schools are just as ripe for such design. Good instructional practice is sound at any level, and all learners benefit from sound practice. Colleges and medical schools are even moving to models in which courses are designed with more connectivity. We must be willing to creatively work around potential barriers such as scheduling, standardized testing, professional development, community perceptions, and time constraints. Educators should always be willing to give the best we have to our students and to our profession, for all of us deserve no less.

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