

Interdisciplinary Education: A Reflection of the Real World

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ABSTRACT

This paper contains a discussion of curricular implications of interdisciplinary education and pedagogical strategies. The focus of the literature cited in this work is on application activities aimed at developing critical thinking, creativity, collaboration and communication to prepare students to meet the challenges of the 21st century. The Know/Do/Be conceptual model for interdisciplinary education, the pros and cons of interdisciplinary education, and pedagogies that lend themselves well to interdisciplinary strategies, such as Inquiry-Based Learning and Team-based Learning, and instructor competencies are examined.

Keywords: Interdisciplinary Education, Critical Thinking, Collaboration, Communication, Real-world Preparation

INTRODUCTION

The world for which educators now groom their students is dissimilar from the world in which public schools were created. The assembly line mentality of the industrial world has morphed into a team-based mindset whereby integrated skills and concepts are applied across a wide range of courses. To excel in the professional environment, today's collegiate graduates should be prepared to go beyond the simple mastery of content and low level thinking [1].

Educators are increasingly coming to the realization that teaching skills and vague concepts without connection to real-world applications are seen by students as irrelevant and in turn, are easily forgotten [2]. If the purpose of teaching is to help prepare for adulthood including meaningful careers, then one can understand why young adults tend to tune out instruction that is focused solely on the acquisition of content. Real world problems "rarely arise within orderly disciplinary categories, and neither do their solutions" [3, p. vii]. To better connect theory and content with application, and better prepare students for the real world of the 21st century, universities are developing interdisciplinary approaches to degree programs. Since knowledge is not acquired in isolation, interdisciplinary education is an important tool in creating new ways of thinking and helping to connect fragmented knowledge in a coherent way.

Interdisciplinary approaches are not new to education. The concept first began in the 20th century and has been commonly associated with the progressive education movement [4 & 5]. Interdisciplinary education allows students to see different perspectives and work in groups with the synthesis of disciplines the ultimate goal. Encouraging students to reach beyond the typical constraints of a single content area and engage in interdisciplinary learning fosters critical thinking, creativity, collaboration and communication skills.

"Interdisciplinary learning enables instructors and learners to make connections across learning through exploring clear and relevant links throughout the curriculum. It supports the use and application of what has been taught and learned in new and different ways. It provides opportunities for deepening learning" [6, p.2]. In *The Logic of Interdisciplinary Studies*, Mathison and Freeman affirm that interdisciplinary studies develops a framework for instructors that allows more authentic relations with students and the ability to teach cognitive skills (e.g., cooperation and critical thinking) that connect to 'real life' learning scenarios [7]. Laura L. Duerr [8] asserts interdisciplinary instruction connects interdisciplinary research with real-world problems. Vacca and Vacca [9] affirm that students from interdisciplinary educational settings prevail in the application of real-world skills. In *Environmental Education*, Staples notes that the integration of interdisciplinary studies offers students "critical thinking skills that lead to discovery and real-world problem solving" [10, p.16]. Moreover, interdisciplinary education helps to increase student achievement by promoting positive attitudes toward subject matter, creating curricular flexibility, and integrating rapidly changing information with increased efficiency [7].

INTERDISCIPLINARY EDUCATION

"The scholarship on interdisciplinarity generally, though not always, stresses the importance of integration: the need to critique the insights of different disciplines and to seek common ground when these insights disagree" [11, p. 2]. As demonstrated through case study, interdisciplinary education allows professors to impart personal knowledge about ideas with colleagues, develop common learning goals and see their discipline from another perspective. Students enrolled in interdisciplinary programs see instructors as they model continued learning, have an opportunity to build upon their individual strengths and become personally invested in their work. Furthermore, students have more ways to associate learning with their interests and relate learning experiences with real-world application [12] as "knowledge in the real world is not applied in bits and pieces but in an integrated fashion" [13, p. 627].

Through the use of interdisciplinary education, critical thinking, creativity, collaboration and communication skills are disbursed within and across the curriculum. This increases the ability of students to make decisions and synthesize knowledge beyond single disciplines, increase the ability to identify, assess, and transfer significant information needed for problem solving, gain a better overall comprehension of global interdependencies, and develop multiple perspectives, points of view, and values. From an instructor point of view, interdisciplinary education is a way to share pedagogical ideas with colleagues and to be energized by seeing one's own discipline from a fresh new perspective [14].

Interdisciplinary education allows students to become proficient in a number of related areas. Instead of limiting instruction to one particular area, a number of disciplines are combined to create a thematic approach with instructors from various disciplines. Interdisciplinary education promotes knowledge transfer as students learn to use the skills and concepts attained in one field and apply it to another. Since students cannot be prepared for every situation, the ability to apply existing knowledge in multiple situations is essential to function effectively in the real-world environment of constant change [15, 16, & 17].

The need for interdisciplinary education has developed as a result of the growth of knowledge, fragmented scheduling and maintenance of curricular relevance [18]. Even with technological innovations that have facilitated interdisciplinary education, creating degree programs is easier said than done. Because of a lack of pedagogy training, instructors rarely have the required competencies to implement interdisciplinary educational models. Moreover, there are a number of logistical problems that should be addressed including classroom scheduling, awarding course credit, sharing resources, teaching assignments, and most importantly, creating and maintaining a team approach to curriculum, lesson design and instructional delivery. Interdisciplinary programs that are not cognizant of logistical issues and do take steps to address those issues are rarely successful [19, 20, & 21].

The importance of interdisciplinary professional training and support for instructors cannot be overstated. Initial professional development sessions should be followed with coaching and relevant workshops. Professional development opportunities will help maintain enthusiasm when interdisciplinary pedagogical strategies are being employed. Administrators should acknowledge the importance of training by allocating appropriate time and resources. Likewise, they should provide recognition for those involved and validate the time invested in professional development for tenure and promotion purposes [22 & 23].

Know/Be/Do Model

Using a Backward Design approach [15 & 16], Drake and Burns [24] developed a concept map for design of interdisciplinary programs called the Know/Be/Do framework (Figure 1). This model is based on three primary questions: What kind of people do we want students to be? What should students be able to do? (What assessments are needed?) What should students know? (What content knowledge is required?)

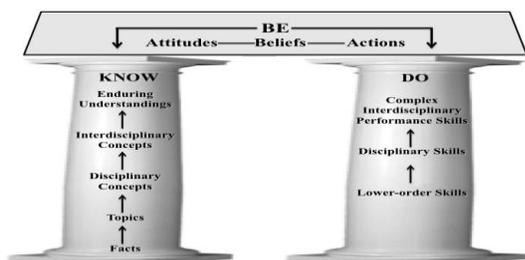


Figure 1. Drake & Burns Know/Do/Be Concept Model

Drake and Burns [25] further delineated their conceptual model by detailing several key components (Table 1). These components are intended to promote student engagement. Understanding by Design, a methodology that connects Backward Design with different levels of learning is integrated throughout the framework [15 & 16].

Table 1. Drake & Burns Know/Do/Be Instructional Framework

	KNOW	BE	DO
	Concepts and essential understandings across disciplines	<ul style="list-style-type: none"> • Democratic values • Character education • Habits of mind • Life skills 	<ul style="list-style-type: none"> • Interdisciplinary skills as the focal point • Use disciplinary skills as a foundation
Assessment	<ul style="list-style-type: none"> • Balance of traditional and authentic assessments • Culminating activity that integrates disciplines taught 		
Conception of Knowledge	<ul style="list-style-type: none"> • Disciplines connected by common concepts and skills • Knowledge considered to be socially constructed • Many correct answers 		
Degree of Integration	Medium/Intense		
Organizing Center	Interdisciplinary skills and concepts embedded in disciplinary skills		
Planning Process	<ul style="list-style-type: none"> • Backward Design • Understanding by Design • Standards-based • Alignment of instruction standards and assessments 		
Role of Disciplines	Interdisciplinary skills and concepts stressed		
Role of Instructor	<ul style="list-style-type: none"> • Facilitator • Specialist/generalist • Coach 		
Starting Place	<ul style="list-style-type: none"> • Interdisciplinary bridge 		

Preparation for the 21st Century Workplace

Interdisciplinary education improves the ability of students to think critically, and improves their creativity, collaboration (ability to work in teams) and communication skills [26]. In a report of over 400 employers across the United States, the most important skills cited were critical thinking, creativity, collaboration, oral and written communication. Employers cited these skills as more important than basic knowledge [27]. The need for improvement is documented by the data from the report presented in Table 2.

Table 2. College Board Ratings of high school graduates by employers

High School Graduates	Applied Skills	1 Def.	2 Adeq.	3 Exc.
	Critical Thinking	69.6%	30.1%	.3%
Creativity	54.2%	43.8%	2%	
Collaboration	34.6%	60.9%	4.5%	
Communication (Oral)	52.7%	45.9%	1.4%	
Communication (Written)	80.9%	18.9%	.3%	
Two-Year College Graduates	Critical Thinking	47.3%	73.5%	3.7%
	Creativity	21.3%	68.4%	4%
	Collaboration	12.1%	76.9%	11%
	Communication (Oral)	52.7%	75.4%	3.4%
	Communication (Written)	47.3%	50.7%	2%
Four-Year College Graduates	Critical Thinking	9%	63.4%	27.6%
	Creativity	16.5%	62%	21.5%
	Collaboration	8.1%	67.3%	24.6%
	Communication (Oral)	9.8%	65.4%	28.4%
	Communication (Written)	27.8%	56.4%	15%

1 = Deficient 2 = Adequate 3 = Excellent

Of the critical thinking, creativity, collaboration and communication skills measured by employers for high school graduates, only .3% - 4.5% were rated excellent; of the same skills measured by employers for 2-year college graduates, only 2% - 11% were rated excellent; and of the same skills for 4-year graduates, only 15% - 28.4% were rated excellent. The skills of 4-year college graduates were higher, but most, 71.6% - 85% were still rated deficient or adequate. Additionally, only 2.7% of employers hired applicants with deficiencies [27].

PEDAGOGIES

“One of the greatest advantages of interdisciplinary learning is that the activities and discussions combine and overlap different subject’s approaches to the same theme of materials and opens the door to using different teaching techniques that appeal to various student intelligences” [22, p. 40]. Two teaching techniques, or strategies, that appeal to various intelligences and present a structure conducive to interdisciplinary education are Team-Based and Inquiry-Based Learning. These strategies foster critical thinking, creativity, collaboration and communication skills. Both utilize group learning.

Some interdisciplinary scholars debate whether the interdisciplinary technique of “team-teaching” is the best approach for student progress in the classroom [28, p. 76]. But in many cases, instructors do not realize common concerns and instead, become bogged down in petty differences [28]. “Team-taught courses often fail to achieve their objectives precisely because the individual members of the instructional team never really begin to understand their common concerns in a fashion that may be properly called interdisciplinary” [29, p. 16]. Team teaching can also be associated with problems such as “lack of ‘sufficient’ time for collaborative work, lack of training in group dynamics, overlapping roles, territorial and status conflicts, and inadequate funding [30, p.18]. Although it has disadvantages, interdisciplinary team teaching still remains a popular instructional strategy.

Team-Based Learning

Team-Based Learning, a form of active learning, is rooted in collaborative learning. Team-Based Learning utilizes very specific instructional strategies including intentional selection and permanence of student teams, a readiness assurance process, and an empowering procedure for students to challenge answers determined by the instructor and peer evaluation. Application activities, based on real-world problems, scenarios, or cases, are constructed around what Michaelsen refers to as the 4 S’s. They are Significant problems, the Same problem, students make a Specific choice in terms of solutions, and each team reports their choice Simultaneously [31, 32, & 33].

Inquiry-Based Learning

Another form of active learning, Inquiry-Based Learning, “is a student-centered and instructor-guided instructional approach that engages students in investigating real world questions that they choose within a broad thematic framework. Inquiry-Based instruction complements traditional instruction by providing a vehicle for extending and applying the learning of students in a way that connects with their interests within a broader thematic framework. Students acquire and analyze information, develop and support propositions, provide solutions, and design technology and art products that demonstrate their thinking, and make their learning visible” [34, p. 1]. Inquiry-Based Learning engages students in the learning process and changes the traditional role of instructor from lecturer to learning facilitator, coach, and model [35]. Inquiry-Based Learning is predicated on building knowledge as opposed to passive learning which follows the more traditional collegiate instructional model based primarily on lecture. Constructivism constitutes the foundation of Inquiry-Based Learning as it fosters the development of thinking skills and collaboration through the use of questions, scenarios, or problems with authentic forms of assessment [36]. Problem-Based Learning (students are presented a problem with only one solution but many methods for determining that solution), and Project-Based Learning (students are presented a problem but there are many possible solutions) are two types of Inquiry-Based Learning.

INSTRUCTOR COMPETENCIES

In a report of a study conducted by the Interprofessional Education Collaborative, an Expert Panel [37] identified 4 core competencies of professional practice for instructors who utilize interdisciplinary pedagogical approaches. These competencies were grouped into 4 domains including Value/Ethics, Roles/Responsibilities, Communication and Collaboration. They are integrated into a framework of teamwork and collaboration among instructors that creates an awareness of each participating members' roles and responsibilities [37 & 38].

As with excellence in any field, for instructors to excel at interdisciplinary education there must first be the desire to do so. Desire represents the foundation for all effective instruction, whether it pertains to interdisciplinary education or not. Beyond desire, instructors should challenge students by presenting them with questions addressing skills and concepts slightly above their existing level of competence. When students reach a new level, an entirely new set of challenges should be presented, once again slightly above their existing level of competence. This scaffolding strategy helps keep students from becoming bored or complacent, and provides them with the support they need to build their confidence [39]. In addition, instructors should have a positive attitude toward what they are doing. Involvement in decision making is the best way to ensure positive attitudes. The "buy-in" achieved through involvement provides them with ownership of solutions to problems they may experience. Students are very perceptive and no matter how instructors try to mask it, if they do not approach pedagogy with genuine desire and a positive attitude, students will pick up on it and become skeptical of the learning process (or lack thereof) [40].

Orlando [41] identified 9 traits of great college instructors that apply to interdisciplinary settings. They include instructors who 1) respect students because each person's ideas and opinions are valued which makes students feel safe to express their feelings and learn to respect and listen to others; 2) create a sense of community and belonging in the classroom through mutual respect by developing a supportive, collaborative environment; 3) are warm, accessible, enthusiastic and caring, possess good listening skills, and never mind taking time out of their busy schedules for anyone who needs them; 4) set high expectation for all students through a realization students perform up or down to their expectations; 5) love learning and are willing to share what he has learned with colleagues; 6) are skilled leaders who focus on shared decision-making and teamwork, as well as on community building; 7) can "shift-gears" by constantly checking for understanding and delivering instruction in new ways to make sure every student understands; 8) collaborate with colleagues on an ongoing basis and do not view collaboration as a sign of weakness but as a way to learn from fellow professionals; and 9) maintain professionalism in all areas from personal appearance to organizational skills and preparedness for each day [42].

Additionally, instructors participating in interdisciplinary education should have excellent communication skills and high levels of creativity. They should believe in team-teaching and active learning, have confidence in their abilities, and not be afraid to take a risk. Instructors who do not possess all of the competencies described in this document based on natural ability should feel comforted by the fact that these behaviors can be learned through professional development and life experiences [41 & 42].

CONCLUSIONS

Opponents of interdisciplinary education assert it creates "jack-of-all-trades, but master of none graduates. They also claim stand-alone departments have a better chance of generating more substantial research projects [12]. Proponents of interdisciplinary education feel it mirrors real-world events because such events are not typically solitary; rather they contain multiple interrelated issues that should be addressed simultaneously to arrive at a solution. Interdisciplinary teaching promotes real-world learning, not isolated educational experiences [10]. As such, the knowledge base for the treatment of complex problems should be expanded, so that it will match the entirety of the aspects of the issues at hand [43]. For example, to resolve problems such as global warming, natural resource management, or poverty alleviation, "many disciplines are needed with inputs that should preferably be balanced and integrated" [44, p. 446].

Involvement in the development of an interdisciplinary model by instructors and students is crucial to reduce resistance and help realize the full potential of the strategy. The College Board suggests the simplest way to support the process of interdisciplinary education is to let students know it's an option and involve them in decision making. Interdisciplinary education not only allows students the opportunity for greater ownership of their learning, but also personal, pertinent, and memorable learning experiences through the use of authentic projects [12].

Implementing interdisciplinary education requires the command of an integrated set of instructor competencies. The inclusion of interdisciplinary pedagogical strategies requires a substantial commitment to professional development, coaching and support by both instructors and administrators. This includes training sessions aimed at supporting pedagogical approaches, such as Team-Based Learning, Inquiry-Based Learning, etc., addressing topics such as student and professorial teamwork, curriculum integration, authentic assessment, reflective questioning, creating application activities using real world scenarios and development of student learning outcomes.

Interdisciplinary education promotes a focus on big ideas and thinking beyond the constraints of a single content area through the acquisition of critical thinking, creativity, collaboration and communication skills. As a result, it may be best suited to prepare students for real-world challenges as today's problems are not contained within discrete skills and concepts, but across a broad spectrum of skills and concepts best addressed through integrated competencies.

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