

BEGINNING BACKWARD: MOVING K-12 STUDENT ACHIEVEMENT FORWARD

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Abstract_ Not often does an opportunity to create a course that combines one's passion along with learning theory, assessment, and research-based teaching practices occur. One such course was created to fill the gap within its program for a Midwestern Teacher Preparation Provider (MWTPP); a course that also met the national accreditation requirements, state mandates, and K-12 classroom needs (i.e. a course that makes a difference in K-12 student achievement; one teacher in one classroom at a time). Data provide strong evidence that the course is making a difference and those pre-service candidates' awareness levels are increasing.

Keywords: Student achievement, Assessment, Learning theories, Backward Design, Teaching practices.

I. INTRODUCTION

Accountability in education, assessment practices, data driven decision making, K-12 student learning and closing the achievement gap are the prominent phrases, titles or topics across educational research articles. These topics originate from several federal reform movements and other initiatives such as the Elementary and Secondary Education Act of 1965 (Title 1), the 1983 Nation at Risk Report, Goals 2000: Educate America Act, and the No Child Left Behind Act of 2001 [1] and from the Common Core State Academic Standards (CCSS) [2].

Educational reforms are not new. These types of initiatives have been scattered throughout education's history [3]. The reforms specifically state what the expected outcomes would be when each was followed. Such results were: accountability; student achievement; increasing test scores; standards; use of authentic, performance, and alternative forms of assessment; annual yearly progress (AYP); highly qualified teachers; and ultimately the rewards and sanctions provided [1]. The commonality across the reforms is student achievement. The push to improve student achievement has resulted in increased testing (e.g. high-stakes testing); making the assessment of students a critical aspect of a teacher's responsibility. If students are not successful academically as evidenced by their test scores, then as perceived by the general citizenry, they are not well prepared for the demands of the work force, will not be productive, contributing members of society, and the economic future of the country and theirs will be drastically diminished [4].

A. BACKGROUND

A diamond was chosen as a unifying image to describe the complexity and beauty of this particular course. First, great care was taken to prepare the diamond; the key was in the cut. A diamond was cut with painstaking precision and each small plane cut out of the diamond is called a facet. In like manner, the undergraduate assessment course was crafted with purposeful precision. The facets of this course were put into place after considerable discussion, brainstorming, and research of learning theories and best teaching practices. Second, the diamond consisted of two main groups of facets, the crown and the pavilion; both are designed to reveal the brilliance and fire within the diamond. The crown was the upper part of the diamond which became visible once the diamond was set in a mounting, whereas the pavilion is the bottom half of the diamond. A diamond cutter is well aware that the angle of each facet must be carefully adjusted to maximize the optical performance of the gemstone [5]. Similarly, the faculty designers of this course critically and consciously designed a curriculum that blended theory and practice to increase the knowledge, understanding, and abilities of undergraduate pre-service students in the area of K-12 assessment. The result was a common syllabus which fulltime faculty implemented that culminated in a common course assessment. And third, the proportion of the angles of the crown and pavilion determine the brilliance and fire of a diamond. The culet is the area where all the facets meet at the base of the diamond; the area that is the basis for a diamond's mounting in any type of setting. The culet or "target" of this course (i.e. where all aspects come together) was to make a positive difference in P-12 student achievement; one teacher in one classroom at a time.

B. Theoretical Foundations of the Course

Knowing what is common to all learners and what is a very individualistic process affects how teachers teach [6]. Planning a lesson and assessing what and how much has been learned depend on knowing how one's students learn [6]. Thus, how learners learn is a critical aspect of the course. Learning theories are conceptual frameworks that synthesize many research studies, embed various learning

principles, and often lead to future research studies [7]. Many educational theorists share some common beliefs: that the study of learning must be objective; that learning theories should be based on empirical research, and that theories provide an explanation of what occurs during the learning process [7]. The learning theories which support and are intertwined with research-based teaching practices were embedded within the course. The theories used in this course as a conceptual framework, follow.

The theoretical frameworks used to guide the development of the assessment course are all embedded in successful and evidence-based practices. This was done so that a more direct link between teacher provided assessments and student achievement could be made visible. The first area of theoretical focus is on classroom theories that focus primarily on student learning, meaning-making, and practices that have been shown to improve student achievement.

Constructivism, for example, focuses on how students learn and how they make sense of that learning [8], a key aspect of achievement. It is built on the work of Piaget [9], Vygotsky [10], and Bruner [11], but also draws from the foundational works of Dewey, Montessori and Kolb. The theory looks at learning as a process where students are actively involved constructing their own knowledge based upon their current and past experiences by making those connections [12,8,13]. A constructivist classroom would be student-centered and a classroom where learning engages students in problem solving activities through discovery, exploration and experimentation [14]. In other words, students are responsible for their own learning. The integration of these types of constructivist teaching practices has been proven to have positive motivational, cognitive, and achievement outcomes [8].

Due to these positive gains in student achievement, a variety of instructional strategies representing aspects of constructivism were used within this course. These include active learning, discovery learning, hands-on, experiential, collaborative, and project-based tasks [8]. Each strategy encourages the students to explore within a structure while the teacher facilitates as students explore, reflect, think critically and interact within the environment to discover the answers to realistic problems building upon their prior experiences to construct new knowledge [15]. Students enrolled in this course interact cooperatively with each other, collaboratively examine samples of previous projects, explore their major's content standards within their assigned learning teams, and reflect based on at least two peer reviews of their work plus the review of the instructor.

Constructivism focuses on how students learn, as well as how they make meaning of that learning. Yet, more is needed. Active learning, a student-centered process that engages students in the learning process [16], can work together with constructivism by helping students make sense of what they are learning by providing activities that require them to reflect critically upon ideas and then to explain how they are using or will use these ideas in the future. Like constructivism, the focus is on the student and what that student does with the learning [15]. Active learning occurs when an instructor structures an environment that encourages active participation. Examples of active learning consist of: pairs of students working collaboratively; classroom discussions; think-pair-share activities; learning pairs; a cooperative learning group (i.e. community of practice); peer collaboration; brainstorming; a quick write; presentations; problem-solving (e.g. discovery-based or inquiry based); or student-lead debates [17,18,15,8,19]. There has definitely been a shift away from the out-dated transmit and receive format (i.e. the sage on the stage) to a more facilitative model where instructors now provide students with the tools to learn for themselves [15]; thereby making learning the responsibility of the students.

In order for undergraduate students to assume more responsibility for their learning, their classrooms need to have a different structure - a structure that engages students in groupings, researching, discussions, and grading. The new structure would need to be more participatory, challenging and would encourage more critical/creative thought to occur [20,21,22]. But merely introducing an activity within a classroom setting does not assure learning will occur. However, using specific principles, such as those embedded within Understanding by Design (UbD), activities that are purposefully designed around the key learning outcomes do have students more engaged in the learning process [16] and the more engaged students are the more learning occurs. An aspect of active learning embedded within this course was the use of varied flexible grouping strategies. The different group configurations were used for synchronous discussions and asynchronous online discussions focused upon assessment related controversies, issues, and practices. Cooperative or collaborative learning, peer learning or problem-based learning strategies all support active learning and these represent the most commonly used forms of active pedagogy [23]. These strategies incorporate the following practices: individual accountability; mutual interdependence; appropriate practice of interpersonal skills; face-to-face interaction; and self-assessment [16]. Across disciplines, results support the power of getting students to work

together to learn – the underlying premise is they must talk to one another and work together; a very real life skill for educators to develop [24]. Individuals are likely to learn more when they learn with others than when they learn alone [25,26]. Collaboration when implemented in classrooms improved learning outcomes [25,26] and increased student learning, social skills, self-esteem, and positive attitudes toward others [27]. In addition, students received new ideas, skills, and knowledge by working with others to solve problems, settle disagreements and misconceptions as well as by giving and receiving feedback [27]. Collaboration also improved student achievement, attitudes, and retention [16]. Based on this evidence, faculty should create courses which incorporate collaboration and establish cooperative learning environments [16].

In the faculties attempt to improve learning outcomes, an aspect of cooperative and/or collaborative learning embedded within this course is the constructed learning team concept. These learning teams meet as professional learning communities based upon the students' major and level of certification (i.e. elementary or secondary). The learning team members collaboratively assist the individual members with the deconstruction of standards, curricular clarifications, and peer editing of the students' three assessment projects by providing descriptive feedback.

Cognitivist, a framework for understanding how the mind works and functions, is another theoretical construct used in the design of the course. This framework is vital for teachers to grasp to reach their goal of improving student achievement. Those who are best known for their work in this area are Piaget and Vygotsky [7]. The underlying principles of Piaget's research explained that children's learning development is sequential in nature; that through their interactions within their environments children build their complex understandings of the world [9]. Vygotsky also studied the thinking processes of children and added to the work of Piaget. He believed children's thinking processes were intertwined with their social interactions (i.e. conversations) and dependent upon their language development [10]. Through his work, Vygotsky coined the term, zone of proximal development (ZPD), which simply means that at this stage of development a child needs guidance from adults or more advanced children, (i.e. similar to Piaget's developmental theory). Based on this type of assistance (i.e. scaffolding) children can complete more challenging tasks and thereby increasing their achievement levels. In addition, he believed that children learn more when working on tasks collaboratively with someone who is more adept at that task; then they are [10]. The structure of the

course thus included the concepts of development learning and scaffolding by allowing for assignments to build upon one another, as students' learning and/or learning also increased from discussion to discussion and assignment to assignment.

Social learning theory is also related to the work of Vygotsky and Piaget. The theory emphasizes the importance of observing and modeling the attitudes, emotional reactions, and behaviors of others. According to Bandura (1977), most of our behavior is learned through observation and then later modeled in future actions. Social learning theory explains that an individual's behavior, environment, and personal qualities all reciprocally (interact/interconnect) influence each other [28]. The components underlying observational learning are: attention – attention must be given to all aspects of the behavior being modeled; retention - remembering the details and reproducing the behavior later; reproduction – organization of responses must model those of the behavior being modeled and practice will help improve the response; and motivation – an incentive to encourage the person to reproduce the behavior. Motivation is the key factor for persons to model the behavior. This means that students can learn but not demonstrate that learning until motivated to do so [28]. Knowing how critical motivation is to learning, the assessment course embeds aspects of the social learning theory, specifically the use of cooperative learning pairs, the learning team format, and flexible groupings. It is the premise that motivation levels will rise within and among the team members in the form of peer editing comments and feedback and that student learning/achievement levels will also increase.

From these cognitivists' perspectives previously mentioned, varying cognitive frameworks of learning began to grow during the 1970s, 1980s, and 1990s. Based on these newer frameworks, constructivist teachers would be influenced by insight, information processing, memory and perception. The teacher in this type of classroom would organize the content and learning activities to focus on building cognition, intelligence and meta-cognitive abilities to improve student achievement [7].

Bloom's [29] taxonomy of educational objectives: has been a commonly used tool by educators for curriculum development and lesson design since 1956 [30]. Bloom is also known for his later research focusing on mastery learning. This work provides "insights into the challenge of reducing gaps in achievement of diverse groups of students [31]. Mastery learning principles consist of: feedback, correctives, and an enrichment process in conjunction with instructional alignment. Teachers who implement mastery

learning provide their students with frequent and descriptive feedback through formative assessments. The information students receive shows students what they were expected to learn, what they learned fairly well and describes what areas/concepts need to be learned better [31].

Aspects of cognitivism that are believed to have the greater impact on student achievement which are embedded within this assessment course are the higher order thinking levels within discussions (synchronous and asynchronous), within the required assignments, and within the pre-service students created assessments. The principles of mastery learning are implemented as demonstrated by the work students do in their assigned learning teams on the three-part assessment project. Students receive written descriptive and prescriptive feedback from at least two team members and the instructor at each stage in the development of their projects; the students use their team members' and instructor's feedback and self-assess their work prior to their final plan being submitted.

Triarchic Theory of (successful) Intelligence contends that intelligent behavior arises from a balance between analytic, creative and practical abilities and that these abilities function collectively to allow individuals to achieve success within particular sociocultural contexts [32]. Analytical abilities enable the individual to evaluate, analyze, compare and contrast information. Creative abilities generate invention, discovery, and other creative endeavors. Practical abilities tie everything together by allowing individuals to apply what they have learned in the appropriate setting. At the center of the three is the individual who chooses which intelligent behavior or behaviors to use at any given moment. Keeping student achievement in mind (i.e. our students and K-12 students), the aspects of this course which fit within the Triarchic model are: Analytical, evaluating, comparing and contrasting assessment samples including the peer reviews of their assessments from their colleagues; creative, students create three assessments based on their content major and choice of grade level in conjunction with the state standards; and practical, assessments constructed are in preparation for the units written.

Inasmuch as assessment practices of teachers, however, have not been sufficiently addressed in teacher preparation programs [33,34], resulting in their graduates using the same type of assessment practices as used by their own teachers. Beginning teaching practices did not look at assessments as pieces of a puzzle which when put together provided the whole picture of a student's achievement, but rather as a mechanism for providing grades. As documented in a survey

conducted in 1999, which found that less than half the states in the United States measured assessment competency on state licensure exams [34]. The newer approach to assessment requires teachers to use their assessment results as valuable pieces of information to inform both their students and their own teaching practices [35]. An example of today's assessment philosophy is after an assessment is given, teachers would reteach the aspects of the content that presented difficulty to the students using different methodology and would then offer students another opportunity to demonstrate their understanding [33,36]. Recognizing the demands of the changing facets of teaching, a Midwestern Teacher Preparation Provider (MWTTP) and state university created an assessment course for its undergraduate pre-service candidates to close the gap within its teacher education program; a course intended to make a difference in K-12 student achievement by combining learning theory, assessment, and research-based teaching practices while simultaneously meeting national accreditation requirements, state mandates, and the needs of K-12 classrooms.

Research Questions

The focus of this study was two-fold. Specific research questions were to determine:

1. In which ways did the newly-created course fill the gap within the MWTTP's teacher education program (i.e. a course to make a difference in K-12 student achievement by combining learning theory, assessment, and researched-based teaching practices)?
2. In which ways did it made a difference (or not) in the elementary student teachers' perception, understanding, and awareness of current classroom assessment practices?

Secondary foci pertained to classroom objectives, feedback, K-12 students' involvement in assessment and their own self-assessment, and communicating the various aspects of assessment.

II. METHODOLOGY

This research project is in an ongoing longitudinal study which is currently in its fourth year. The project occurred over eight semesters and is separated into four different phases.

A. Subjects.

The subjects for this project were elementary student teachers (N = 985). The student teachers had all completed their first teacher assisting practicum (i.e. a half-day, every day experience in an elementary classroom for fifteen-weeks and were just beginning their full day experience).

B. Instrument.

A nine-question survey instrument with a 5-point Likert scale (see Table 1) (originally used by the Assessment Training Institute but later modified for pre-service student use) was implemented [36]. In essence it was a two-fold

survey in that it utilized the data to assess the student teachers' awareness and knowledge levels of assessment, as well as an assessment of the course.

Table 1
Assessment Survey

- 1 = Teachers don't do this, or this doesn't happen in classrooms where I have been**
- 2 = Teachers do this infrequently, or this happens infrequently where I have been**
- 3 = Teachers do this sometimes, or this sometimes happens where I have been**
- 4 = Teachers do this frequently, or this happens frequently where I have been**
- 5 = Teachers do this on an ongoing basis, or this happens all the time where I have been**

#	Survey
	1. Do you think teachers understand the relationship between assessment and student motivation and use assessment to build student confidence rather than failure and defeat?
	2. Do you think teachers can articulate, in advance of teaching, the objectives their students are to accomplish?
	3. Do you think teachers inform their students regularly, in terms they can understand, about the objectives to accomplish, in part through the study of the criteria by which their work will be evaluated and samples of high-quality work?
	4. Do you think students can describe what objectives they are to accomplish and what comes next in their learning?
	5. Do you think teachers transform these objectives into dependable assessments that yield accurate results?
	6. Do you think teachers consistently use classroom assessment information to revise and guide teaching and learning?
	7. Do you think teachers' feedback to students is frequent, descriptive, constructive, and immediate, helping students know how to plan and interpret?
	8. Do you think teachers' students are actively, consistently, and effectively involved in assessment, including learning to manage their own learning through the skills of self-assessment?
	9. Do you think teachers' students actively, consistently, and effectively communicate with others about their achievement status and improvement?

Adopted from Classroom Assessment for Student Learning 2004, Assessment Training Institute

C. Analysis of Data

The initial phase consisted of three semesters of data (see Table 2). During their first large group meeting prior to the beginning of their placement, the student teachers completed the assessment survey instrument. During this phase, no elementary student teacher had taken the assessment course, thus providing the project with baseline data, since the course was first offered during the Winter semester of 2010.

The second phase of the study involved the data tabulation process. Each semester, data were tallied and a combined Likert score (i.e. between one and five) was calculated for each question. The process followed was: (a) each student teacher's responses were recorded for the rating

assigned to each question (e.g. a ranking of 3 for question one, would have been recorded under column three for question one, etc.); (b) after all responses were recorded the total number for each column for each question was calculated; (c) the total number for each column was weighted by the Likert level assigned (e.g. column 3 had a total of 12 which would yield a combined score of 36); (d) each question had the possibility of five combined totals (i.e. one total for each column); and (e) each question's combined score column totals were added together and that total was then divided by the total number of respondents which resulted in a combined Likert score. A final step was completed for each question by averaging the three combined Likert scores (i.e. the scores for three semesters) (see Table 2).

Table 2
Baseline Data Tabulation

Fall 2009 N = 175	Winter 2010 N = 110	Fall 2010 N = 110	Survey Questions
3.77	3.0	3.06	1. Do you think teachers understand the relationship between assessment and student motivation and use assessment to build student confidence rather than failure and defeat?
		3.28	
3.96	3.6	3.68	2. Do you think teachers can articulate, in advance of teaching, the objectives their students are to accomplish?
		3.75	
3.55	3.19	3.1	3. Do you think teachers inform their students regularly, in terms they can understand, about the objectives to accomplish, in part through the study of the criteria by which their work will be evaluated and samples of high-quality work.
		3.28	
2.86	2.69	2.2	4. Do you think students can describe what objectives they are to accomplish and what comes next in their learning.
		2.58	
3.42	3.14	2.56	5. Do you think teachers transform these objectives into dependable assessments that yield accurate

			results?
3.46	3.28	3.04 3.45	6. Do you think teachers consistently use classroom assessment information to revise and guide teaching and learning.
3.72	3.43	3.40 3.32	7. Do you think teachers' feedback to students is frequent, descriptive, constructive, and immediate, helping students know how to plan and interpret?
2.82	2.8	3.49 2.58	8. Do you think teachers' students are actively, consistently, and effectively involved in assessment, including learning to manage their own learning through the skills of self-assessment?
3.24	2.66	2.73 2.7	9. Do you think teachers' students actively, consistently, and effectively communicate with others about their achievement status and improvement
2.87			

The third phase consisted of five semesters worth of data. During this phase, students gradually began to matriculate through the program after taking the required assessment course (see Table 3).

The next phase (i.e. fourth phase) involved the second tabulation process. The identical tallying and combined score

process used in the second phase was followed during this phase as well. During this phase a distinction was made based on the percentage of elementary student teachers who had taken the course. Once again, a final step occurred for each question by averaging the five combined Likert scores for each question (see Table 3).

Table 3
Second Data Tabulation

Winter 2011 N = 106	Fall 2011 N = 120	Winter 2012 N = 110	Fall 2012 N = 174	Winter 2013 N = 80	Survey Questions
(*6/106 or 6%)	(*13/120 or 11%)	(*27/110 or 25%)	(*50/174 or 29%)	(*69/80 or 86%)	
2.51	3.1	3.62	3.9	3.96 3.42 (+1.45)	1. Do you think teachers understand the relationship between assessment and student motivation and use assessment to build student confidence rather than failure and defeat?
4.2	3.86	3.9	4.25	4.31 4.1	2. Do you think teachers can articulate, in advance of teaching, the objectives their students are to accomplish?
3.36	3.3	3.7	4.1	3.86 3.66 (+.50)	3. Do you think teachers inform their students regularly, in terms they can understand, about the objectives to accomplish, in part through the study of the criteria by which their work will be evaluated and samples of high-quality work.
2.55	2.57	3.14	3.58	3.76 3.12 (+1.21)	4. Do you think students can describe what objectives they are to accomplish and what comes next in their learning.
3.21	3.08	3.67	3.33	3.92 3.44 (+.71)	5. Do you think teachers transform these objectives into dependable assessments that yield accurate results?
3.82	3.5	3.77	4.23	4.19 3.90	6. Do you think teachers consistently use classroom assessment information to revise and guide teaching and learning.
2.83	3.33	4.2	4.36	4.31 3.81 (+1.48)	7. Do you think teachers' feedback to students is frequent, descriptive, constructive, and immediate, helping students know how to plan and interpret?
3.06	2.81	3.24	3.33	3.44 3.18	8. Do you think teachers' students are actively, consistently, and effectively involved in assessment, including learning to manage their own learning through the skills of self-assessment?
3.72	3.08	3.1	3.35	3.45 3.34	9. Do you think teachers' students actively, consistently, and effectively communicate with others about their achievement status and improvement

*percentage of students who had taken the assessment course by semester

A future phase of this longitudinal study is planned to utilize a correlational design to determine levels of significance for student achievement. Faculty will follow pre-service student teachers into their assigned classrooms to observe the assessment practices which the students implement to improve K-12 student achievement. Practices specific to classroom objectives, feedback, K-12 student involvement in assessment, self-assessment and communicating the various aspects of assessment will be the focus.

In order to interpret the data findings the following criteria was implemented:

1. A consistent increase/decrease in combined Likert scores of individual survey questions across semesters.
2. A consistent increase/decrease in combined Likert scores of pre-course survey data and post-course survey data by question.
3. A significant difference was interpreted as >1.0 or <1.0 whereas a moderate difference was interpreted as >.5 or <.5 (see Tables 2 and 3).

III. RESULTS AND ANALYSIS

The primary purpose of this study was to determine in which ways the newly-created course filled the gap within the MWTPP's teacher education program. According to the results of the post-course survey data a significant increase in awareness levels of student teachers in their knowledge development and understanding of what teachers know, understand and do in classrooms in relation to what their students learn and receive was evidenced by three questions: 1 (+1.45); 4 (+1.21); and 7 (+1.48) (see Table 3). A moderate increase in awareness levels of student teachers in their understanding of what teachers communicate to their students and what teachers do to obtain accurate assessment results was evidenced by two questions: 3 (+.50) and 5 (+.71) (see Table 3). A fairly consistent increase in awareness levels of students teachers in their own self-reflections and involvement in best assessment practices was observed in the post-course survey data from five questions (i.e. 1, 5, 6, 7, and 8) (see Table 3). Data showed that the most significant increase (i.e. +1.48, question 7) was the student teachers' understanding the importance of feedback, specifically the type, timing and frequency. Based on previously cited research this understanding will impact K-12 student achievement positively.

IV. DISCUSSION AND CONCLUSION

A gap was filled in a MWTPP's teacher education program and a difference was made in the elementary student teachers' perception, understanding and awareness of current classroom practices as evidenced by longitudinal data (see Tables 2 and 3). The data indicate that the course did make a difference across time because our elementary student teachers had a heightened awareness of teacher responsibilities that include: (a) lesson planning (i.e. its purpose, what it will accomplish, and what students will learn as a result) and assessment (i.e. use of assessment information to revise and guide teaching/learning); (b) improving K-12 student achievement through the use of feedback and classroom assessment practices to revise their teaching; and (c) involving K-12 students in assessment, including self-assessment and communicating various aspects of assessment.

The study had some limitations: (a) it is not yet into the correlative phase of the research, which will provide if the findings across time are significant; (b) it cannot yet address K-12 student achievement as the outcome for this course; and (c) it is confined to one Midwestern Teacher Preparation Provider (MWTPP).

Based on the results of this study, however the assessment course created for undergraduate pre-service

candidates did successfully close the gap within the MWTPP's teacher education program so far. The culet or "target" of this course (i.e. where all aspects came together) was to make a difference in K-12 student achievement by combining learning theory, assessment, and research-based teaching practices while simultaneously meeting national accreditation requirements, state mandates, and the needs of K-12 classroom; one teacher in one classroom at a time. The data provide strong evidence that the course is making a difference and those elementary student teachers' awareness levels are increasing. It is recommended to better document improvement of K-12 student achievement, data need to be collected while the students are completing their student teaching semester.

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