

**The Cognitive Trio:  
Backward Design, Formative Assessment, and Differentiated Instruction**

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**Abstract**

In a traditional classroom of mixed ability levels, it is recommended that differentiation is the answer to helping all students achieve success (Heacox, 2012). This necessitates a shift from a “one size fits all” approach to one of greater emphasis on the individual in the learning process. While teachers seek ways to look at teaching, assessing, and learning through this different lens, the issue of successfully implementing differentiated instruction (DI) in the classroom continues to be challenging. This issue will be discussed with a focus on blending two major elements, backward design and formative assessment, as essential components in supporting and incorporating differentiated instruction in classrooms with mixed ability levels.

*Keywords:* backward design, differentiated instruction, formative assessment, student achievement

**Introduction**

On a typical day in a typical classroom across the United States, despite old and new teaching and learning theories, teachers remain perplexed about how to help all students successfully meet high academic expectations (Whipple, 2012). Confronted with as many as three different groups of learners in the same classroom, teachers continue to ponder ways to help all students gain maximal success: those who already have it and need to be challenged, those who are beginning to understand and need new instruction to move ahead, and those who don't get it who are in need of immediate attention. Several decades ago, this would not have been a grave concern. The focus was primarily on content, making sure that the material was taught (Hattie & Zierer, 2019). Differences in the audience, the learners, was not the focus. Lessons were taught with the hope that students would understand them; this mindset is no longer acceptable. As explained by curriculum experts, Gregory and Kuzimach (2004), teachers are held accountable for all learners, “not only those who learn in spite of us, but also those who learn because of us” (p.1).

To appreciate the significance of this shift, it is important to reflect on Benjamin Bloom's concept of *mastery learning* promulgated in the 1970s (Bloom & Carroll, 1971). Bloom believed all children can learn and proposed a model to support his beliefs. Mastery learning included an initial assessment, feedback, corrective instruction, and additional assessment (second chance). The corrective instruction was tailored to each individual's needs (Bloom & Carroll, 1971). Bloom's work, then, can be viewed as the precursor to differentiated instruction (DI). While the name, mastery learning, of the 70s is different from that of today, the goal remains the same: maximal student learning. More currently, mastery learning focuses on personalized learning, a progressive student driven model whose defining attributes of personalized learning complement the intention of DI practices. The four attributes - voice, co-creation, social construction, and self-discovery - are integral to the students' individual learning profile (Kallick & Zmuda, 2017). In a DI environment, teachers are attentive to these attributes in helping students achieve maximal success.

As explained by McTighe and Willis (2019), "the most effective teachers ... are mindful of, and responsive to the needs of the learners they serve" (p. 128). Addressing diverse learner needs begins with grasping a clear understanding of differentiated instruction, backward design, and formative assessment together with understanding the relationship and interplay among these three powerful constructs. While all three elements of the cognitive trio are not new, considering each in concert with the other is more important than ever before. The literature review in this article revisits differentiated instruction, backward design, and formative assessment as essential components of the cognitive trio's prominence in student achievement. This integrated three-pronged framework for improving learning for all students will be highlighted in the discussion.

### **Review of Literature**

#### **Elements of Differentiated Instruction**

Well known author on Differentiated Instruction, Tomlinson (2005), defines differentiated instruction as "teaching with student variance in mind" (p. 9). Differentiated Instruction is predicated on the notion that students learn differently and that, accordingly, if students learn in different ways, they should not all be taught the way. In her early works Tomlinson (2001) describes what differentiation is and is not. She helps clarify differentiations' misconceptions. For example, differentiation is not individualized instruction as promoted in the 70s. DI is not chaotic, nor is it just another way to provide homogeneous grouping. Differentiation is proactive and

student centered. It is rooted in assessment and provides multiple approaches to content, process and product. It is a blend of whole-class, group, and attention to individual learner needs (Tomlinson, 2001).

As defined by Chapman and King (2005), “differentiation is a philosophy that enables teachers to plan strategically in order to reach the needs of diverse learners today” (p. xxii). Expanding her previous work, Tomlinson (2015), describes differentiated instruction as a research-based model of classroom practice that, “stresses the interrelated roles of classroom environment, curriculum, assessment, instruction, and classroom leadership/management” (p. 203). Many Algebra I teachers realize planning a differentiated learning environment is essential in supporting maximal student success. An example of this relationship can be demonstrated in planning a unit of instruction on linear functions in an Algebra I course. First, Algebra I teachers define what students should know and be able to do at the end of the new unit on linear functions. Then, they plan pre-assessment opportunities to gauge entry level readiness of students and design activities which respond to differences in student learning profiles and interests. Next, teachers prepare instructional strategies to meet learners at different levels of understanding including informal assessments for monitoring student understanding of key concepts such as slope, intercepts, graphing and applications. Technology resources are included to support learners both independently and collaboratively. Lastly, with end of unit expectations in mind, culminating assessments are designed to determine students’ overall understanding of linear functions. Thus, the objective of using a backward design planning process as the gateway to connect instruction and assessment practices in a DI environment is accomplished.

### **Using Backward Design**

Stephen Covey (1989), in his well-acclaimed book, *Seven Habits of Highly Effective People*, explained that effective individuals plan with the end in mind. Backward design is a concept widely used in many professions, including education and healthcare (Daugherty, 2006; Emory, 2014). Its goal may be to maximize profits, improve services, decrease spending, improve productivity, or improve student learning and performance. What the future will look like is articulated and plans are put into place for moving forward. In the field of teaching and learning, McTighe and Wiggins (2012) affirm, “effective curriculum is planned backward from long-term, desired results” (p.1).

With improved performance for all students as the goal of educators, using backward design in the planning process is key (Tomlinson & McTighe, 2006). This approach allows teachers to ensure big ideas communicated in content standards are not overlooked. Using a backward design approach in a standards-based environment compels teachers to set targets, collect evidence, and plan meaningful instruction to help students achieve learning goals. This provides the backdrop for differentiating learning for individual student success.

As described by McMillan (2007), the backward design approach consists of the three stages described below. Each stage is guided by several essential questions. “Essential questions serve as doorways to understanding” (Tomlinson & McTighe, 2006, p. 112). They communicate big ideas and deepen understanding for students. Essential questions take into account students’ differences in prior knowledge and skill levels (Tomlinson & McTighe, 2006).

Stage 1: Identify desired results. This requires identifying what students should know, understand, and be able to do. What essential knowledge should be clarified and understood by all students? What are the learning goals? Clarity for teachers and students is essential in stage one.

Stage 2: Determine acceptable evidence. This requires considering in advance the assessment evidence needed to confirm that the objectives or goals have been met. That is, how will we know that the student knows? During this stage, assessment options are explored, with an emphasis on assessment *for* learning and gaining mastery of important content. Assessment *for* learning helps the student demonstrate content knowledge which comes later in the learning cycle.

Stage 3: Plan instructional activities and instruction. What formative strategies, activities, and resources will be used to help students meet the learning goals? How will these resources provide evidence that students are making progress? The intent of this stage is to engage learners in meaningful learning as they move ahead keeping the end in mind.

Teachers are equipped to make good decisions at all stages of the instructional process when they understand backward design and use it consistently. The teacher focuses on essential questions, gathers and analyzes data during instruction, and gains competency in anticipating students’ questions and concerns on unit topics. Differentiation permeates the culture benefiting students who are behind, in the middle, and advanced.

Differentiated instruction allows teachers to present a range of learning activities. A variety of assessment strategies are implemented to monitor students’ progress and move students forward (Thousand, Villa, & Nevin, 2007). Using backward design in planning instruction and assessment

strategies, teachers make choices regarding what will be taught, *content*; how it will be taught, *process*; and what students will do to demonstrate learning, *product* (Tomlinson & Imbeau, 2010).

Student success is paramount in the learning environment. This major objective requires flexibility from the onset and permeates each component of the cognitive trio. This mindset guides the backward design planning process and continues throughout instruction. Teachers engage students in multiple paths to learning by using a variety of strategies to accommodate learning styles, interests, needs, and readiness levels in a way that is developmentally appropriate, appealing, and meaningful (Taylor, 2015). Incorporating DI strategies is integral in a backward design framework aimed at student interests, readiness, and learning profile (Tomlinson & Imbeau, 2010).

When leaders model the backward design approach, a culture of utilizing this process is created. In particular, supporting personalized learning and creating habits of mind in the school community requires educational leaders to think flexibly, innovatively, and creatively (Kallick & Zmuda, 2017). When leaders demonstrate these qualities, teachers are likely to think broadly and deeply, increasing the potential for success in integrating backward design, an essential component of implementing the cognitive trio.

### **Formative Assessment and Feedback**

The focus of assessment in classrooms throughout the United States has been to measure how much students have learned within a period of time. The emphasis was on the test or project at the end of a unit of instruction, summative assessment. In more recent times, the shift has changed to using assessment to monitor student progress during instruction, formative assessment (Stiggins & Guskey, 2007). In a study of elementary school teachers' perceptions regarding differentiated instruction in the classroom, Davis (2013) explained while teachers value the use of assessment data in helping students improve, many teachers believe a greater understanding of different types of assessments and how to meaningfully use them will contribute to differentiation efforts in the classroom.

Instead of a test at the end of a unit gauging entry level understanding of a topic, educators should plan assessments to inform instruction throughout the unit. In order to determine student knowledge, pre-assessments can be used to determine the baseline data of where the students are in the learning process. Guskey and McTighe (2016) noted potential benefits of using pre-assessments with students which included determining prior knowledge and skills, monitoring

progress, communicating expectations of what is about to be taught, checking for misunderstandings, and identifying students' interests, talents and preferred learning styles.

Formative assessments are usually informal. They are teacher made, provided during instruction, and are key in motivating and guiding students to achieve success in meeting learning goals. It is not a single occurrence, nor is it simply a right or wrong verbal or written comment. It is descriptive and ongoing throughout instruction. Formative assessment provides concrete information to the student on how to improve. These informal formative assessments guide teacher decisions on ways to differentiate instruction to improve student performance (Conderman & Hedin, 2012). The teacher knows before the end of the unit where each student has challenges or some may even be ready to move ahead. Information gathered from students provides feedback to the teacher which allows adjustments in instruction. This deliberate action step demonstrates attentiveness to individual learner needs which bolsters performance of the entire group.

In contrast, formal assessment typically occurs after instruction. It is summative and associated with grading. Its purpose is to provide feedback on how well students have achieved mastery of learning objectives (Bahr & DeGarcia, 2008; Conderman & Hedin, 2012). Instructional adjustments are not made following summative assessment on a unit of instruction. Using the idea inherent in differentiating *product*, it is conceivable that DI can be utilized in providing choice to demonstrate mastery. According to Tomlinson and Imbeau (2010), differentiating product "is a rich culminating assessment that calls on students to apply and extend what they have learned over a period of time" (p. 15). Summative assessment may be in the form of a performance task, a portfolio, a demonstration using technology, open ended questions, or an appropriate assessment aligned with unit objectives.

A review of literature reveals much attention has been given to distinguishing between formal and informal assessment as well as formative and summative assessment. Regardless of the term assigned, at the core of any assessment is providing feedback so students know how to improve their understanding and produce high quality work. It is a reciprocal process which benefits both the student and the teacher (Bartz, 2017; Chappuis & Chappuis, 2008).

In discussing the reciprocal process between teacher and student, Popham (2014) explains formative assessment as a planned process in which evidence of students' progress in gaining mastery of content is used by the teacher to adjust instruction and by students to adjust their learning strategies. Embedded in the formative assessment process is the critical role of the teacher.

Content, assessment criteria for understanding content, and instructional strategies are essential steps in this planning process. Critically important in monitoring progress is collecting information, formative assessment. Formative assessment is any method of providing feedback to students prior to completing a unit of instruction, while there is still time to improve (Vatterott, 2015). While this is beneficial to the student, the teacher also benefits by engaging in an ongoing process of adjusting instruction and instructional strategies to continue to move the student to deeper understanding (Hattie, 2012). Vatterott (2015) describes feedback as a “two-way recurring conversation between teacher and student” (p. 58).

More vividly, Tomlinson (2014) explains the process of feedback as “an ongoing exchange between a teacher and his or her students designed to help students grow as vigorously as possible and to help teachers contribute to that growth as fully as possible” (p. 11). In this context, feedback is generally viewed in several ways: between the teacher and an individual student, between the teacher and a group of students, and peer to peer.

In their discussion of the value of formative assessment, Chappuis and Chappuis (2008) stress the role of the teacher in helping students answer three major questions: Where am I going? Where am I now? And, how do I close the gap? While the student grapples with each question, the teacher shares the responsibility in helping the student find answers to these questions. By gathering data on student understanding, the teacher is able to diagnose misconceptions, identify areas of concern, and suggest what needs to be done to close the gap. By engaging in this collaborative process, the student begins to reflect on his or her own work; self-monitoring is meaningful and setting goals for oneself provides motivation for advancing in learning.

The common thread throughout the research on formative assessment is emphasis on gathering information on what students know and do not know and then providing feedback for improving (Popham, 2011). It is descriptive, timely, and ongoing. It is intended to help the student move to the next level of learning by identifying what the student already understands while offering suggestions for how to improve in areas not yet mastered. Because the intention of this type of assessment is to move the student forward in the learning process, it is commonly referred to as assessment *for* learning (Stiggins, Arter, Chappuis & Chappuis, 2006).

In discussing formative assessment, Popham (2008) explains that formative assessment is a process. Putting it succinctly, he stresses that “Formative assessment is a planned process in which teachers or students use assessment-based evidence to adjust what they’re currently doing”

(p. 6). His conception of formative assessment has four attributes: a planned process, assessment-elicited evidence, teachers' instructional adjustments, and students' learning tactic adjustments. Popham consistently uses the phrase "formative assessment process" in his work as a way to stress that it is a process, not a single strategy or test. This idea is sometimes difficult for educators to accept. But herein lies the connection between backward design and formative assessment. When this connection is understood and accepted, differentiated instruction happens in the lives of teachers and students. Backward design incorporates planning, activities, and instructional strategies to address learner needs demonstrated through monitoring student progress using formative assessment tools. Based on information gathered from students, teachers apply DI principles in advancing student performance.

### **Backward Design, Formative Assessment, and Differentiated Instruction**

Now that each component of the cognitive trio has been discussed independently, establishing their interconnectedness is essential in understanding how they work in concert to promote maximal student success. This interconnectedness does not happen automatically. With focused attention on some preliminary steps (backward design), the intended benefits of the trio have the greatest potential of being realized. These steps include building the relationship between objectives and the tenants of DI and designing essential questions aligned with objectives. Another essential step, not to be overlooked, is collecting and analyzing student data. Highlighting these preliminary steps will set the stage for maximizing both teacher and student success.

The first step in designing meaningful assessments, both formative and summative, is to write clear statements of what students should know and be able to do. While this seems very practical in the world of teaching and assessing, this recurring theme is prevalent in the literature on classroom assessment (Brookhart & Nitko, 2014; Stiggins & DuFour, 2009). It is evident in the backward design approach and is particularly important in determining appropriate assessment planning in a differentiated environment. According to Fink (2013), backward design should focus on producing noteworthy learning experiences for students. These experiences include assessment activities to advance learning for all students.

The learning targets as discussed by Chappuis, Chappuis and Stiggins (2009) are directly connected to the tenants of DI. Knowledge targets are *content* driven, reasoning is related to *process*, and performance skill targets and product targets are *product*. Chappuis, Chappuis and Stiggins (2009) list four categories of learning targets with which assessments are to be aligned:

- *Knowledge targets*, students will remember and understand key concepts
- *Reasoning targets*, students will use their knowledge to analyze, evaluate, and problem solve
- *Performance skill targets*, students will apply what they know to demonstrate one or more skills
- *Product targets*, students will create something.

These targets provide a clear picture of what achievement will be measured. They represent clear statements of intended learning. The learning targets aid in selecting the appropriate assessment method to reflect the intended outcomes so that results can be interpreted accurately. Teachers have choices in selecting assessment methods to gauge progress in achieving learning targets.

As learning objectives are constructed describing what students are to know and be able to do, a second step in making connections is reflecting on what data is needed to determine where students are, and specifically, what area of understanding needs attention. Just as students are pushed to reflect on their work as a meaningful step in monitoring their own progress, teachers, too, must engage in an ongoing process of reflection. This is critical in incorporating a backward design approach into instruction and assessment. As validated by Brookhart and Nitko (2015), important decisions must be made by the teacher before, during, and after instruction. These decisions are intricately connected to assessing for learning. These decisions take into account the needs of all learners; they require reviewing data and responding to learners at various stages in grappling with deep understanding of essential concepts. As teachers ponder these questions, they must also think of what assessment methods will provide useful information to inform good decisions. Relying on an essential questions approach provides clarity in the overall teacher decision making process. Brookhart and Nitko (2014) recommend teachers ask questions before, during, and after instruction. Some possibilities include:

#### Before instruction

- What are the expectations? In what ways will I communicate clear expectations?
- What do I need to know about students' readiness, interests, and abilities?
- What strategies will I use to motivate students to want to learn?
- How do I meaningfully engage all students in learning? In self-assessing? In pre-assessing?

- How will I arrange the learning environment for the lesson?

#### During instruction

- What feedback will I provide to each student? Or, group of students?
- How will I provide feedback in a timely manner during class, on homework, individual and group projects?
- How will I know what students have learned and what they can do?
- How will I challenge students to move to the next level of mastery?
- In what concrete ways will I connect content to real life applications?
- What opportunities will I give students to revise their work?
- What types of scaffolding do students need in order to provide appropriate support or intervention in learning challenging material?

#### After instruction

- How well are students achieving objectives?
- What strengths and areas for improvement will I point out to students?
- How effective were strategies I used to help students better understand?
- What should I do differently next time?

These teacher decisions are not intended to be exhaustive. Instead, the focus is to suggest that many pieces of information are needed to make good decisions. Each set of questions is accompanied by a companion assessment method that provides information to the teacher. The type of information needed varies from one group of students to the next. Using this information is a hallmark of an effective teacher in the differentiated classroom. In the earlier example of the Algebra I unit on linear functions, teachers planning the unit will utilize these questions or a subset of these questions in determining what must be done to meet the needs of diverse learners before, during, and after instruction.

As student data is collected and reviewed through this ongoing process of reflection and decision making, the third step, planning and implementing, must begin. Planning and implementing, however, are not enough. On-going monitoring of student progress is critical. This is the only way to know the backward design and the formative assessment planning process are improving learning. As described by Wilson (2016), cognitive processes can be easily monitored, documented, and tracked. When monitored consistently and strategically, all students have optimal opportunities for success and improved learning, the goal of the cognitive trio. This monitoring

process takes into account planning (backward design), formative assessment, and differentiation strategies. It is at this point that teachers experience the inherent benefits of purposefully integrating the dynamic trio into the learning environment.

### **Conclusion**

This discussion established the need to connect backward design, formative assessment, and differentiation to the learning process in a more deliberate and comprehensive way. To achieve this objective, the three concepts were first revisited independently. The three were then considered to formulate a more deliberate and integrated perspective resulting in benefits for both teacher and learner. Achieving desired results necessitate defining non-negotiable elements: establishing and communicating clear expectations, holding all students to high standards and providing high-quality instruction. Utilizing a backward design approach ensures that these elements are in place. Collecting and analyzing student data before, during, and after instruction cannot be neglected in a differentiated classroom environment.

In a differentiated classroom, when scaffolding is incorporated, learner needs are more likely to be met (Tomlinson, 2001). Teachers use scaffolding to provide students help they need in learning a concept or skill in different ways and in smaller increments until they are able move forward on their own (West, Swanson, & Lipscomb, 2017). Differentiation provides a variety of ways to organize learning through content, process, and product, based on students' interests, readiness, and learning profile (Tomlinson & Imbeau, 2010). In essence, scaffolding and differentiation are both focused on meeting learner needs and moving students from where they are in the learning process to where they need to be.

Using a backward design approach is the vehicle for accomplishing the overarching goal in helping students achieve learner goals. From the onset, teachers focus on what students are expected to know and be able to do at the conclusion of a unit of instruction, a semester, or at the end of a course. Once this is decided, the focus changes to helping students reach these goals. Monitoring students' progress requires on-going attention to their understanding and provides feedback for improvement. That is, priority is given to formative assessment which occurs during instruction. In an environment characterized by formative assessment, a culture of success is established for students. Self-confidence is bolstered through feedback on strengths and descriptive feedback for improving. Teachers know how to respond to students who need

immediate attention; they know how to move those in the middle forward, and push those who have met the objectives to new learning heights (Wiggins & McTighe, 2005).

High-stakes learning permeates 21<sup>st</sup> century teaching and assessing. All students are expected to be college and career ready. Teachers are held accountable for their success; they cannot afford to guess what to do next in the classroom. In designing support systems for 21<sup>st</sup> century students, learning must be relevant, personalized, and engaging (Battelle, 2019; Gregory & Kuzmich, 2004). The reflective and thoughtful practitioner realizes the power in this responsibility. Differentiation, using backward design and a carefully planned formative assessment process, will help ensure the continuing growth and achievement of all students. The integration of this cognitive trio provides a rich learning environment which supports optimal learning for all students.

To create and maintain actionable momentum requires rethinking and retooling what and how we do what we do. We must first reenergize and revitalize faculty by providing new learning opportunities in how to ground their work with the cognitive trio in the forefront. Incorporate DI strategies by including a variety of real-life classroom scenarios which can be incorporated into courses within the teacher preparation program. To further promote understanding and consistency incorporating the trio, it is recommended that stakeholders including administrators, instructional specialists, teacher mentors, lead teachers, and coaches from schools within the district participate in similar sessions as those conducted for faculty. This invigorating experience will create a fresh mindset and permeate the learning environment throughout the entire district.

Faculty must move candidates from theory to practice bridging the gap between what they learn in courses and what they are able to effectively do before entering the first year of teaching. It is recommended that courses within the teacher preparation program be restructured with greater emphasis on efficiently and effectively implementing differentiation with this comprehensive approach. The goal is to usher in new generations of teachers equipped with the knowledge and skills to grapple with and meaningfully respond to the complexities of diverse learner needs. To accomplish this goal, faculty must provide deliberate and focused instruction, particularly in methods and assessment courses, in designing learning experiences with the end in mind, incorporating formative assessment, and using differentiation strategies with fidelity. By incorporating a problem-solving model (scenarios) using data representative of diverse learners,

teacher candidates gain the competency and confidence to make good decisions as a result of understanding the interconnectedness of the cognitive trio.

It is recommended that research be conducted to determine the impact of integrating the cognitive trio in the learning environment. The overarching focus will be two-fold: to gain insight related to student achievement as well as the overall impact this way of teaching and learning has on school culture; and, to determine the challenges and barriers of integrating the cognitive trio into the learning process.

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