Backwards Design for Quality Course Builds

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An increase in the offerings of online and hybrid courses, and even in the use of a Learning Management System in face-to-face courses, has led to a need to develop high-quality online components and full course design. As students continue to interact with course elements in a virtual setting, it is important to ensure that they are doing so in a manner that is effective and easy to understand, leading to rather than hindering them in success. An effective strategy can not only help students in achieving success, but can also assist instructors in the course design and development process.

This literature review will explore one of these strategies, known as backwards design, and its effect on helping establish a framework for quality course builds. This review is primarily targeted towards the online aspect of online and hybrid courses, but the theme and elements from the study can be applied to in-person courses as well. The goal of this study is to identify the value of developing a professional development opportunity for instructors in using backwards design to develop their courses.

School and Classroom Context

Arizona State University (ASU) is a large higher education institution with about 110,000 students as of the fall of 2018, over 35,000 of which are strictly online students via the ASUOnline programs (Faller, 2018). Beyond that, many on-campus students are enrolled in online courses outside of this online population, as ASU offers two different types of online courses - icourses and ocourses. An icourse is a course that is open for any student to take and is offered fully online. An ocourse is similar but is restricted to ASUOnline courses that are part of

an entirely online degree program. Therefore, it is safe to say that the number of students participating in online courses is even greater than the 35,000 enrolled in ASUOnline.

The icourse and hybrid courses (on-ground courses with an online component) offered at ASU means that more and more faculty are teaching online, even if they are not part of an online program. According to ASU's Course Enrollment Manager (CEM) database, ASU typically runs about 2,500 summer courses, 10,000 fall courses, and 10,000 spring courses in the University's chosen Learning Management System (LMS) (Arizona State University, 2019). These are courses that are either fully online or have an online component to them. ASU has also recently gone through a change in LMS, moving away from Blackboard, which it had previously used as a primary LMS for about 20 years, and introducing Canvas as its new University-wide LMS of choice. This has placed ASU faulty in a position prime for the re-evaluation of their online offerings as they begin to port their courses into the new platform.

Purpose

The purpose of this literature review is to explore how backwards design is beneficial to quality course design and how a professional community can support instructors in learning to properly implement backwards design in an online format.

Rationale

With a large number of online and hybrid courses being offered, it becomes increasingly important that faculty understand some of the best practices for teaching online in order to provide quality online offerings. ASU's dedication to their online courses and degree programs opens the doors for more and more courses and programs to be brought online and offered out to the world. It is important then, that these courses adhere to the standards and expectations of the

university and provide a solid foundation for learning. One of the fundamental practices for creating a strong organizational structure and proper alignment of course materials in order to provide a quality learning experience for students is backwards design.

Using backwards design, faculty would first begin by determining the pedagogical goals (learning objectives) of the course and work backwards to determine the appropriate materials to meet those goals (Cooper, 2017). In working backwards, faculty would next consider the design of their assessments to measure the goals they have identified. Next, faculty would begin to develop course materials and lesson plans to help students succeed in performing well on the assessments and meeting the objectives of the course. In this process, faculty start by determining the end result for the students and what they are to learn from the class, and work backward to ultimately develop their materials and determine what information is and is not important in the scheme of their objectives.

From experience, not all faculty consider this process when developing their courses, and even less perhaps when developing online courses. Instead, as Wiggins and McTighe state, "too many teachers focus on the teaching and not the learning" (2005). Many faculty first consider what they will teach throughout the duration of the course, developing lesson plans and developing and gathering materials and resources, then develop assessments based on these plans. They then only consider what the student will ultimately learn at the end of the design process, if at all. Many faculty do not even consider or develop learning objectives or course goals at all, instead only focusing on what to teach. Backwards design offers the faculty a method of course development that has the student's learning in mind and can perhaps offer an easy way of creating a quality course.

Since ASU has recently gone through the migration from one LMS to another, an opportunity has arisen for faculty to review their courses and revise them for improvement. The new LMS (Canvas) has a different layout than the old (Blackboard), and thus, for some faculty, revision may already be necessary. Though the integration of backwards design suggests the course will need to be redesigned from the ground up, much of what many instructors currently have may still be used, but given proper alignment and structure in order to improve their effectiveness.

Literature Review

The literature review examines backwards design as a whole, as well as the individual components of which it consists, broken down into learning objectives, assessments, learning materials, and course structure. Each category is explored in order to provide a cohesive view on the process of backwards design and its merits in accordance with current research. The review also seeks to determine the benefit or providing a Professional Learning Community (PLC) to support proper and effective implementation of backwards design by faculty in their courses. Finally, the synthesis of the research will guide an overview of the implications in implementing backwards design via a PLC.

Backwards Design

Even under the best intentions and immense effort from faculty, courses can suffer from poor course design, leading to a less effective learning experience. Williams and McTighe (2005) offer several vignettes of learning experiences, each covering a different situation and their suggestions towards understanding and curriculum design. In these vignettes, some of which are true accounts while others are fictitious accounts based on common practice, scenarios

were presented that may have had a lot of effort and good intention put forth by the faculty or instructor, but ultimately led to little understanding by the student. One such vignette was a reflection delivered by a veteran English teacher on her years in high school as a student. This reflection recalled that the instructor was able to memorize material as a student, leading to her becoming valedictorian. She felt embarrassed, however, that she actually understood less about the material than some of the other students as she was rarely given assessments calling for her to demonstrate deeper understanding. Williams and McTighe suggest that "even 'good' students don't always have a deep understanding of what's been taught" (pg. 2), which further suggests that a good student under the instruction of a good teacher does not guarantee success in learning and understanding, even when conventional measures such as course grades and cumulative GPA do in fact suggest so.

Backwards design is meant to fill the gap in designing and delivering a learning experience to students that promotes understanding and not just memorization and recall. Williams and McTighe (2005) see teachers as designers (pg. 13) and certainly they are designers in crafting curriculum, lesson plans, learning materials, and more for their courses. Teachers may often have instructional designers to assist with these processes, but it is just as important for those designers to understand the needs of their audience - in this case, the students. Students need to be provided with a course design that promotes and properly assesses understanding. All too often, material is just provided to the student based on a topic without consideration of an end goal of comprehension. As Williams and McTighe (2005, pg. 14) put it, "our lessons, units, and courses should be logically inferred from the results sought, not derived from the methods, books, and activities with which we are most comfortable."

Backwards design involves three stages set forth by Williams and McTighe (2005). Stage one involves the identification of desired results. This refers to the development of learning objectives, considering the end goal for your students and what they should learn by the end of a lesson, unit, or course. Stage two is the determining of acceptable evidence. This involves the development of assessment tools to properly measure student understanding and proficiency. In other words, this stage is about creating items to measure how well the students meet the goals set in place in stage one. Finally, the third stage involves the planning of learning experiences and instruction. This includes developing the learning material, instructional activities, and the educational experience that will best support the students in their performance on the assessments developed in stage two and, ultimately, their success in achieving the learning objectives from stage one.

Cooper, Soneral, and Brownell (2017) recommended in their article that these three stages set forth by Williams and McTighe be utilized to develop course-based undergraduate research studies (CUREs). The CUREs in question are rooted in scientific research and consequently involve both research goals and pedagogical goals. While there was existing evidence that instructors were already using backwards design to develop courses with consideration to pedagogical goals, there was no evidence that there was also consideration of research goals. Cooper, Soneral, and Brownell (2017) call for the use of backwards design, recognizing its power in developing courses and its ability to maximize scientific research milestones and student learning." They suggest the development of both the research goals of the course and the pedagogical goals by first starting of broadly, and then becoming more specific, and then using those goals to inform methods of collecting acceptable evidence or mastery, and finally, planning learning experiences. They then introduce the idea of revision and iteration into

this cycle in order to take an evidence-based approach in providing "maximal and equitable opportunities for student learning." This is not necessarily a part of backwards design but could be an effective tool in ensuring effective learning experiences. There are limitations to the case of the CUREs, however. Research opportunities may be limited depending on the context of the course. For example, a CURE may rely on the instructor's research and only provide students the opportunity to analyze data but not collect their own. Despite limitations such as this, Cooper, Soneral, and Brownell provide a good look at how backwards design can be effectively implemented to address course pedagogical goals as well as research goals.

Learning Objectives

The first step in backwards design is developing the learning objectives for the course. Learning objectives, also known as course or learning outcomes or goals, are the intended end results of students. In other words, they describe what the students are expected to know or be able to do by the end of a course or unit. One method of developing sound learning objectives is through consideration of Bloom's taxonomy. Bloom's Taxonomy, as described by Forehand (2005), is a hierarchical system that categorizes the cognitive skills of learners across 6 levels. Each level is subsumed by the levels above it, meaning that a student functioning at one level is also able to demonstrate mastery of the levels below. The levels include, in ascending order, knowledge, comprehension, application, analysis, synthesis, and evaluation. While these levels differ slightly across several models, these are the most often used levels and provide a basis for the other models.

Knowledge is the lowest order of cognitive skills as listed in Bloom's Taxonomy, and is often the only level addressed and measured in courses, as evidenced by the teacher's reflection

in the vignette offered by William and McTighe (2005). In instances of this nature, students are only asked to recall information and spew memorized facts instead of demonstrating sufficient understanding and higher thinking. Consequently, the use of Bloom's taxonomy in developing course objectives can help guide the learning process towards higher levels of the cognitive hierarchy. As suggested by Adams (2015), Bloom's taxonomy can provide value by highlighting a need for including learning objectives that incorporate these higher levels of cognitive function and thus lead to more substantial learning experiences for students. Additionally, Adams suggests that Bloom's taxonomy can help instructors and designers consider objectives in behavioral terms. This includes the use of action verbs in writing objectives, in order to illustrate what students will be able to do as a result of instruction. These action verbs provide measurability to the objectives and can indicate the best method of student assessment (Adams, 2015). This is an important factor in writing learning objectives, as it leads directly into the second stage of backwards design.

Assessments of Understanding

The second stage of backwards design addresses assessments. Assessments help collect evidence of student understanding in accordance with the learning objectives developed in stage one. In situations of proper implementation, assessments are aligned with the learning objectives to best measure student achievement. Without proper alignment, the objectives may not be measured fully, if at all, through the assessments and, furthermore, course materials may not prove relevant to the overall course goals.

Fitzpatrick, Hawbolt, Doyle, and Genge (2015) conducted a study to determine whether objectives and assessments for two courses were aligned and if they included higher-order

thinking. To evaluate the alignment of the assessments and objectives, as well as the level of cognitive skills involved, the study used a group of three experts to conduct alignment analyses. These experts varied in expertise in order to strengthen validity evidence. To determine alignment, the experts analyzed the assessments to determine if any objectives were addressed, and then if any objectives were not addressed. They then determined how well the cognitive levels of the assessment matched the cognitive levels of the corresponding objectives.

The study also incorporated focus groups. Twelve volunteer students were recruited through purposeful sampling who were representative of students in the program. These students were divided into focus groups of three to four and subjected to semi-structured interviews. These interviews were meant to determine whether they felt the assessments matched the objectives and also to determine the thinking processes involved to address assessment tasks, helping to establish the level of cognitive function prompted by the assessment.

While the study had limitations in the size of both its evaluation group as well as its student sample, the results of the study provided insight into course alignment. According to the study, the evaluators found that "the alignment results did not support a strong claim of content validity for the assessments" (Fitzpatrick, Hawbolt, Doyle, and Genge, 2015). In other words, the assessments did not adequately address the learning objectives of the course. Consequently, students suggested that the assessments did not address all of the objectives and that even when they did, they did not necessarily reflect the more important concepts behind those objectives. Furthermore, the students felt as though they were not always assessed for higher-order thinking in accordance with course objectives. This study serves to illustrate the importance of establishing properly measurable learning objectives of higher cognitive skill levels and, in turn, aligning those with well-designed implements for assessment.

Beyond the alignment of assessments to objectives is the type of assessment itself and its capability of providing meaningful learning in tandem with the learning objectives. Assessments can be either summative, addressing how much the student has learned by the end of the course, or formative, measuring student learning throughout the course as it progresses. While both have a place in academia, they require their own brand of attention in order to provide deeper learning for students.

A study conducted by Bijrsterbosch, van der Schee, and Kuiper (2017) aimed to identify prevalent knowledge and cognitive processes in local secondary education and to identify beliefs, attitudes, and conceptions among instructors regarding assessment. Focusing on final exams as part of a pre-vocational education program, the study was analyzing school-based assessments meant to prepare students for an external examination process. Forty-nine instructors across 13 institutions participated in submitting examinations for review. These exams were run through a software called Ephorus to check for and remove duplicate questions, leaving 108 unique test items for evaluation.

First, the study utilized a taxonomy table to determine the level of cognitive skills involved in the assessment tasks. The results of the content analysis found that the vast majority of the assessment addressed conceptual knowledge. Only a small percentage (10%) of assessment tasks deal with higher-order cognitive skills. Next, to gauge instructor attitudes, beliefs, and conceptions 15 instructors participated in a two-panel interview to discuss these results. These interviews showed that instructors were able to identify the pattern of lower-level, knowledge-based items in the examinations, but were not surprised, as remembering is an important factor in assessments in pre-vocational education. This could prove to be a limitation to this study, illustrating that, in this situation, it was purposeful and applicable to rely largely on

the cognitive level of knowledge. However, since these assessments were designed to prepare students for external evaluations, it was also suggested by instructors that more higher-order learning would be desirable, but they are hesitant to do so because they are teaching to a test outside their control. This study illustrates the promise that a summative assessment carries, but also identifies potential shortcomings. Testing students on their cumulative knowledge can be beneficial for measuring the achievement of goals, but proper alignment and cognitive skills need to be incorporated in order to achieve meaningful learning.

A research study in formative assessments and their impact on student learning performed by Bakula (2010) was designed to demonstrate that instructor feedback can help shape student learning and reach struggling students. This study relied on formative assessments to gauge student understanding, followed by instructor feedback to ultimately assist in improved performance on a summative assessment. Bakula performed the study on her 95 seventh grade students, but only collected data from a single course of 19 students and their performance on six formative assessments and one summative assessment. After delivering a formative assessment, Bakula would review student performance, paying special attention to assessment items pertaining to key concepts, and would then deliver reteaching of material on which students underperformed. Supplementally, Bakula collected surveys to identify misconceptions for the students to guide reteaching, but primary data was obtained through formative assessment evaluations.

The study found that revisiting material with which students struggled in the formative assessment improved their performance on the summative assessment. The instructor was able to identify problem areas and address them appropriately due to the review of the formative

assessments and students were able to use the formative assessments to prepare for the summative.

While the Bakula study was limited in that it did not measure alignment of assessment items with objectives, nor did it identify the cognitive skills addressed by the assessments as done in the study by Bijrsterbosch, van der Schee, and Kuiper (2017), it is still noteworthy as it shows the value in incorporating formative assessments to provide a deeper understanding of course content. With proper alignment and incorporation of higher levels of cognitive skills, formative assessments and summative alike can provide meaningful learning for students and guide them on a path of mastery in higher-order thinking.

Learning Materials

The third and final stage of backwards design is the development of instructional content. Content must be aligned with both the assessments and course objectives. When Wiggins and McTighe suggest that "teaching is a means to an end" (pg. 19), it is clear that course materials must be designed with end goals in mind. While the concept of delivering instructional content in order to provide information relevant to the assessments and, ultimately, the learning objectives for the course is rather simplistic in nature, the ways in which these materials can be delivered is something worth considering. For example, an instructor may know what information must be conveyed to the students in order for them to perform well on their exams and achieve success with the course's end goals, but they may not know how to best convey that information. This is where other factors come into play, helping determine the most effective methods of delivery for the content at hand.

One such consideration is the format of the information and how it is presented to students. As identified by Schiefelbein (2012), Media Richness Theory (MRT) can provide a framework for establishing what methods to use when presenting students with course content and information. MRT describes how and why certain media are used to deliver content (Schiefelbein, 2012). In essence, it states that the more complex the information being delivered, the richer the media needs to be. The theory provides a scale of media richness, illustrating that text is the least rich media and is, therefore, suitable to easily convey simple information, whereas synchronous teleconferencing is the richest form of media possible and is more suitable for conveying more complex information. The media richness scale provides a range of possible mediums between these two, including audio-only elements like podcasts, visual elements without audio, and audio-visual formats like videos, organized and tiered by their ability to achieve four goals. Those four goals are the medium's ability to send multiple cues, support language variety, provide immediate feedback, and allow personal nature to be communicated (Schiefelbein, 2012). Teleconferencing is able to achieve all four of these goals, for example, and is therefore considered one of the richest forms of media.

Consideration of MRT can help provide a framework for developing content for student consumption. When incorporated in conjunction with backwards design, content can not only be aligned with assessment items and learning objectives, but information can also be delivered in an effective manner to potentially maximize meaningful learning, knowledge retention, and student success. Students are provided with relevant information and a suitable modality for better understanding and success.

Beyond the scope of the medium of delivery of course content is the way in which it is presented to and accessed by students, particularly in online and hybrid courses. At this point,

course navigation is the primary concern. In order to help students succeed, they need to be able to easily locate and access the course materials. No matter how well designed and developed content may be, it won't do any good if a student is not able to find it. In a study by Finley (2019), the navigational system of an online course was simplified and streamlined for student use in order to determine the effect of course navigation on student satisfaction and ease of locating course information. Students from two sections of the course were asked to evaluate their experience in consideration of the aforementioned factors prior to the redesign of the navigational system. This served as the pre-test for the analysis. Two sections of a separate run of the same course were then asked to evaluate the course in consideration of the same set of factors after the redesign, serving as the post-test. The results were then analyzed and compared and a T-test showed that there were fewer questions throughout the course and higher students satisfaction, indicating the impact course navigation can have on student satisfaction and success. This further suggests the importance of delivering content in an easily navigable way so that students are able to easily access the materials they need to help them succeed.

The design of course learning materials and the manner in which they are presented can further promote student understanding as it pertains to Universal Design for Learning (UDL), which suggests three networks involved in student learning (Al-azawei, Serenalli, and Lundqvist, 2016):

1. Recognition Network: The 'what' of student learning. Learners use different methods of categorizing information

2. Strategic Network: The 'how' of student learning. Learners use different methods to organize and express their own concepts.

3. Affective Network: The ‘why’ of student learning. Learners can be engaged via different methods.

Providing multiple modalities and well-planned methods of access for course information can help address some of the factors considered in UDL. As stated by Al-azawei, Serenalli, and Lundqvist (2016), UDl represents “designing flexible and accessible educational settings.” This provides students with meaningful access to information that they can consume in an effective and accessible manner and allows students to interact with the course in ways that promote deeper learning and a better understanding of core concepts.

Course Quality Assurance

While not officially a part of backwards design, the use of a quality assurance framework can help assure a quality course build. A nationally recognized community has already established a standard framework for guiding and ensuring quality course creation in online environments. Quality Matters (QM) is a community that has established a program To help ensure quality course offerings. One of the stages of this program, if not the most important stage, employs the use of a rubric to check courses against eight general standards that cover the following course components and competencies (Maryland Online, 2018):

1. Course overview and introduction
2. Learning objectives
3. Assessment and measurement
4. Instruction Materials
5. Learning Activities and Learner Interaction

6. Course Technology
7. Learner Support
8. Accessibility and Usability

Clearly, this rubric is relevant to the process of backwards design, as standards two through six directly refer to the development of learning objectives, assessments, and the instructional content and how it is delivered. Additionally, as mentioned by Varonis (2014), the QM program promotes the strategic alignment of learning objectives, course assessments, and learning content, the cornerstone of the three stages of backwards design.

Altogether, the development of a course via backwards design can prove beneficial for instructors and students alike. The process, executed with consideration of proper methods of writing learning objectives under Bloom's taxonomy and what assessments are best to use, as well as MRT and UDL, and ultimately reviewed in relation to a framework like the QM program standards, can work to create high-quality courses for student success. The process may seem extensive, but can provide a natural flow and can undergo revision and iteration. A well-designed course can provide clear direction for students, as well as a deeper understanding, and can also provide an effective way of measuring student achievement, the ultimate goal of any course.

Professional Learning Communities

According to DuFour (2004), Professional Learning Communities (PLCs) operate in accordance with three "big ideas" that represent their core principles:

1. Ensuring that students learn
2. A culture of collaboration

3. A focus on results

Essentially, a PLC serves to help make sure students are learning and does so through collaborative measures amongst faculty participants. There is then a reflection on the results of the PLCs effectiveness which can then lead to revision. This is no easy task, however, as faculty are required to "focus on learning rather than teaching, work collaboratively on matters related to learning, and hold itself accountable for the kind of results that fuel continual improvement" (DuFour, 2004, pg. 6).

While DuFour illustrates the first principle of PLCs as the school's and faculty's direct intervention with students to determine what students learn and to make sure they are learning it, this is not necessarily directly applicable to higher education. DuFour cites a directive intervention program at Adlai Stevenson High School in Illinois as an example in this type of direct intervention. In the example, students of the high school receive progress reports every three weeks in order to identify any issues. Within the first month of class, if a student is showing signs of trouble, they meet with the teacher, counselor, and faculty advisor in order to identify the root of the problem in an attempt to correct it. This is a very active method of ensuring that students are learning but is unfortunately not a scalable initiative that could prove viable to a university of tens of thousands of students. The concept of ensuring student learning in general, however, is certainly applicable to the interests of PLCs within a university in relation to the main goals of professional development (PD) opportunities.

To depict the concept of collaboration in PLCs, DuFour refers to Boones Mill Elementary school in Virginia where the school's third-grade teachers communicate with one another to identify essential skills and knowledge they feel students should master in their grade level.

These faculty then collaborate with the fourth-grade teachers to hear their expectations for what students should know and be able to do upon entering fourth-grade classrooms. Combining all of the shared information, the third-grade teachers then generate the learning outcomes for the third-grade class. This example again is not directly applicable or scalable for a higher education institution with high enrollment, but the underlying concepts can be applied to PD opportunities. PD itself can be a collaborative process, building off of shared knowledge and input from a collective.

Finally, DuFour identifies Freeport Intermediate School in Texas as an example of the third principle of PLCs in its methods of using results to ensure the effectiveness of instructional programs. At Freeport instructors work collaboratively every day to discuss the outcomes of their grade levels and align them with state standards. They then deliver the same assessments to the students of the grade level and analyze the results. This process helps identify which teachers may be better at teaching the students in certain areas. The teachers look for this successful practice in an attempt to replicate it and improve their students' performance. Once again, this is not a scalable practice that can be iterated at the university level. However, instructors can observe the effects of their implementations from PD experiences on students by analyzing student performance and behaviors in their own courses.

Synthesized research by Kennedy (2019) sought to determine the most beneficial form of PD for teachers. Kennedy found that PD for teachers were generally designed with one of three approaches in mind relating to what the teacher or instructor needed to learn. These approaches included teaching teachers on content knowledge, strategies and insights, and procedures. Content knowledge PD seeks to simply provide more subject matter expertise among faculty and leaves the rest up to them. Strategies and insights PD looks to inform faculty of ways to develop

and adapt instruction programs to specific circumstances within the classroom environment and meet individual student needs. Procedures PD included the methods by which the instructor conveyed information to the student and the steps they followed to do so. Procedure-based or strategic-and-insight-based PD are the approaches that would be designed to address backwards design. PD that focuses on strategies and insights takes into account procedures as well but takes it one step further to accommodate the student. While Kennedy identifies PD that adheres to the strategies and insights approach as the most beneficial for students, this approach is not always the most suitable for higher education. Similar to DuFour's examples of PLC principles, the strategies and insights approach to PD is not easily scalable. Instructors of a high-enrollment university course cannot be expected to use adapt learning materials to attend to the needs of individual students when they are teaching to a class of 300. While some university courses can certainly benefit and even adhere to this approach, it is not transferable to all levels of courses and course enrollments. Kennedy (2019) identifies the content knowledge approach as the weakest of the three and notes that the procedures approach is similar to the strategies and insights approach, but the latter is more beneficial due to its room for flexibility. Procedures-based PD, therefore, holds merit in certain situations, while PD that addresses strategies and insight should be sought after whenever applicable.

Professional development and professional learning communities hold great value in the educational setting. While the specifics presented in the research gathered by DuFour and Kennedy are not necessarily scalable to the high enrollment and size of a large university, the underlying principles and concepts are structurally sound and outline the benefits of PD and PLCs for instructors. Research by both found instructor experiences in PD and PLCs to be positively tied to student success.

Implications

The research reviewed presents several implications regarding how a professional community can support instructors in learning to properly implement backwards design in an online format. First, the concept of backwards design is largely beneficial in seeking to design and develop a quality course and improve student success. Backwards design follows three stages as drafted by Wigginss and McTighe (2005) that call for the design of aligned course materials, assessments, and learning outcomes. Research presented by Cooper, Soneral, and Brownell (2017), illustrates the benefits of backwards design on student learning and research experiences.

Furthermore, the individual components of backwards design, including the development of measurable learning objects, the alignment of assessments, and the development of aligned course content, have been shown to have positive impacts on student success. Properly developed and considered learning objectives can help students identify the end goals of their courses and find meaning in their coursework. As illustrated by Adams (2015), the use of Bloom's taxonomy to establish learning objectives can also highlight the need for instructors to develop objectives rooted in higher-order cognitive skills. This leads to better student understanding of core concepts and more meaningful learning.

Assessments, as part of backwards design, have been shown to be beneficial for student learning in both formative and summative methods. Fitzpatrick, Hawbolt, Doyle, and Genge (2015) showed that faculty and students alike felt that assessment tasks that addressed higher-order thinking and cognitive functions and were appropriately aligned with learning objectives would improve understanding. Bakula (2010) showed that formative assessments allowed for

strategic intervention with students and led to improved performance and deeper learning experiences.

Learning materials, the final stage of backwards design, have a clear impact on student learning as they are the items of knowledge delivery for students. Media Richness Theory, Universal Design for Learning, and Quality Matters, however, strengthen the foundations of these materials in that they provide multiple modalities, effective methods, and accessible modes of consumption of content. Materials developed with consideration to these frameworks are more readily obtained and understood by students and can lead to improved satisfaction and performance amongst students.

Finally, Professional Learning Communities and professional development opportunities can help in providing concepts and frameworks to instructors and train them in using backwards design to develop or revise their courses. While a strategic-and-insights based approach would be most beneficial for student success according to Kennedy (2019), this may not be suitable for all levels of university instructors. A procedures-based approach, however, would be suitable and would adequately provide a foundation for effective PD that ultimately leads to improved student performance.

Each of these implications suggests benefits for meaningful student learning and course quality. While the research had limitations related to environments outside of the scope of higher education and large-scale universities, the concepts presented therein show merit towards environments within a university. Research that was conducted in systems of a smaller scope were not always transferable to higher education. However, their concepts relate to general

educational principles and professional learning experiences and are transferable across systems of any size.

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