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# Editors and Editorial Board

# Letter from the Editor

***Kathleen J. Tate, Ph.D.***

Welcome to the Spring 2017/Summer 2017 issue of Internet Learning journal! In this issue, you will find book and media reviews, perspectives from the field, and research and theoretical articles. Themes of motivation and collaboration are woven throughout the topics in this issue, which include student interactions, student success, immersive technologies, and assessment.

Dr. Tisha Duncan's book review provides an overview of the Whitaker, Zoul, and Casas (2015) book, *What Connected Educators do Differently.* She states that the text provides guidance about how to increase professional and personal connections. Dr. Duncan shares that the book is relevant for educators at all levels from primary to post-secondary in both traditional and online settings.

Dr. Christina Dryden addresses assessment, data, and rubrics in her media review. Choosing a rubric type for an institution or program can be a daunting process. She focuses on a short list of features such as *ease of use* and *uncomplicated reporting* to consider, simplifying the rubric selection process.

In the From the Field section, Russell Poulin, Director, Policy & Analysis, WCET—The Western Interstate Commission for Higher Education (WICHE) Cooperative for Educational Technologies, is featured in *3 Questions for an Online Learning Leader*. He offers insights about regulations from different oversight agencies regarding the state authorization of distance education programs. Russ also discusses e-learning issues and solutions, the shift to mobile learning, and digital tools that are underutilized.

Research and theoretical articles in this issue examine student success, connections between constructivist teaching and student interactions, and immersive technology in a preservice teacher context. Drs. Vignare, Wagner, and Swan explore the use of data analytics as an innovation trigger for supporting student success. They frame their work through innovation science and the predictive analytics reporting (PAR) framework. The authors make a compelling argument for an external community approach for developing common data definitions and an organizing framework that identifies and categorizes student success interventions.

Drs. Michael Miller-First and Kristin Ballard present a way to apply constructivism to adult learners in the online classroom. They elucidate five user friendly constructivist-based teaching methods, including *interactive learning*, *facilitative learning*, *authentic learning*, *learner-centered learning*, and *high-quality learning*. Miller-First and Ballard emphasize that students should not merely navigate an instructional environment; rather, they should experience meaningful and authentic



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activities that help develop skills relevant to problem-solving within and beyond virtual classroom walls.

Finally, Dr. Kevin Graziano expands the body of literature on the use of current immersive technologies with preservice teachers. His study examined undergraduate teacher candidates' motivational reactions to self-directed online instructional materials used to study and apply immersive technology, augmented, virtual, and 3-D reality in an online, educational technology course. Data were collected using the *Instructional Materials Motivation Survey* and he shares implications for educators, instructional designers, and both network and academic administrators.

This issue provides a variety of approaches and resources for university constituents to consider. Articles capture research, theory, and experience from the field. As always, I hope you extract discussion points that you can share with your own students, colleagues, or supervisors to prompt new directions in discourse, research, and practice.

*Enjoy!*

Dr. Kathleen J. Tate,

Editor-in-Chief of *Internet Learning Journal*

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# The Value of Common Definitions in Student Success Research: Setting the Stage for Adoption and Scale

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## Abstract

*As the fascination with innovation continues to catalyze change in contemporary post-secondary education, the field of innovation science is beginning to emerge, so that the relationships between and among the endeavors of Invention, Innovation, and Implementation are better understood. This article explores the use of data analytics as an innovation trigger for supporting student success. Very few organizations have approached improving student success using an open strategy that involves data scientists and the many implementers of student success working across America's college campuses. In an effort to expand student success research, the Predictive Analytics Reporting (PAR) Framework created common data definitions and organizing principles to support collaborative student success research among like-minded universities. By starting with common data, the members of the PAR collaborative have the ability to share, compare, and disseminate results, insights, and strategies for student success. The approach is yielding interesting research on success factors within student segments and learning modalities. The ability to share the results paves the road to adoption at other institutions or within systems.*

***Keywords:*** *student success, Predictive Analytics Reporting (PAR) Framework, data definitions, predictor categories, collaborative, success factors, retention, progression, Student Success Matrix (SSMX)*

## Introduction

I***nnovation*** refers to a new way of doing things: incremental, radical, and revolutionary changes in thinking, products, processes, or organizations. A distinction is typically made between *invention*, an idea made real, and *innovation*, the real-world application of an invention in practice.


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When an invention is applied to solve a problem or to do something completely differently than it has been done before, innovation occurs. *Disruptive innovation* is a term, theory, and phenomenon defined and analyzed by Clayton M. Christensen beginning in 1995, based upon his work in the corporate arena (Christensen, Raynor, & McDonald, 2015). A disruptive innovation is one that creates a new market and value network and eventually disrupts an existing market and value network, displacing established market leading firms, products, and alliances.

As demands for improving higher education have increased, American higher education has become increasingly drawn to the proposition of innovation, in general, and with disruptive innovation in particular. Examples of disruptive innovations include for-profit colleges, online learning, and competency-based education, providing students with pathways that provide a variety of alternative approaches toward program completion as they work toward high-value certificates and degrees. Learning analytics promises to be another disruptive innovation.

The challenge in higher education is that the *implementation* of a new idea in practice—that is, taking an invention, and putting it to work so that innovation occurs—depends upon implementers willing to navigate through the myriad changes to practice that ripple through institutions when a new idea is introduced to current practice. Some innovations simply have too much associated overhead, are not conducive to scalability, or may be too hard for mere mortals to use. Practitioners are much more willing to commit to an implementation when it solves a problem.

Finding common ground between innovators and implementers can be tremendously challenging. Everett Rogers sought to explain how, why, and at what rate new ideas and technology spread in his Diffusion of Innovations theory, first published in 1962. Rogers (2003) suggested that four variables influence the spread of a new idea: the innovation itself, communication channels, time, and a social system (see Figure 1). He suggested that this process depends heavily on the people involved in the adoption of an innovation, since an innovation must be widely adopted in order to self-sustain. He described categories of adopters as innovators, early adopters, early majority, late majority, and laggards. He further noted that diffusion manifests itself in different ways and is highly subject to the types of adopters and innovation–decision processes.

The advent of data analytics has brought opportunities for testing new methodological techniques—including business intelligence, predictive analytics, and data mining—for measuring the impact of innovations on educational outcomes, and making sure to bridge the distance from innovation through implementation, on the way to adoption. The excitement comes from the promise of disrupting old, ineffective practices by replacing them with new innovative ones, guided by data-analytics. The work is motivated by

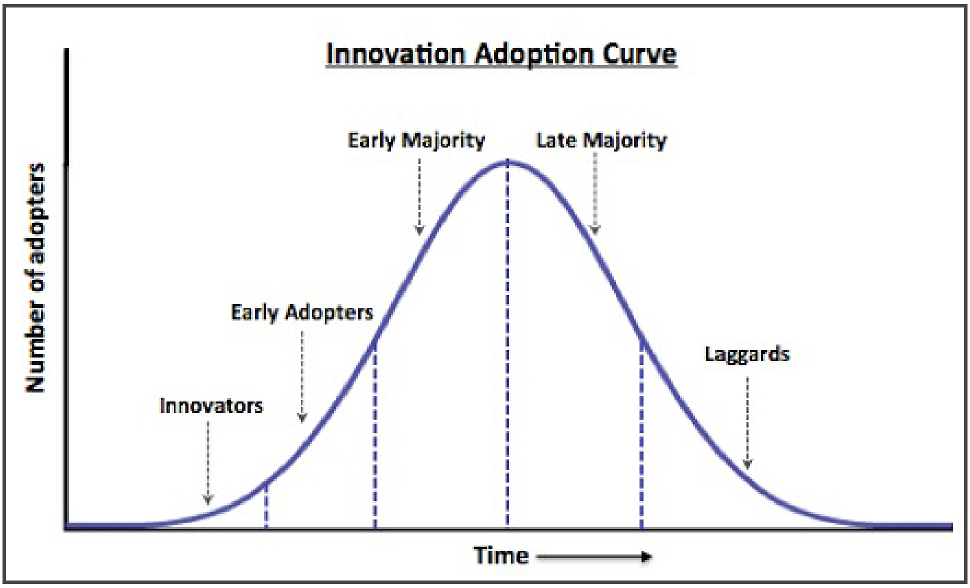


*Figure 1*. Roger's Diffusion of Innovation. Downloaded 10.17.16 http://bit.ly/2enXbUY

the promise of being able to generalize research results beyond a single experimental condition, a single pilot program, or a single institution. The danger comes from *not* evaluating educational technology innovation using empirical evidence, generated using open frameworks and common data definitions.

The methods of the academy have traditionally forced the evaluation of innovation-in-practice to be measured using experimental and quasi-experimental methods that employ inferential statistics and small *n* studies under relatively tightly controlled conditions. The introduction of learning analytics introduces the ability to explore the effects of interventions on all participants in the messy situations they inhabit. This in itself is disruptive, as are the more global changes that use of learning analytics diffuse through higher education (Swan, 2016).

This article explores the use of data analytics to guide student success initiatives in the context of a particular, cross-institutional collaborative project, the Predictive Analytics Reporting (PAR) Framework. What is perhaps most important about the project is that it created a social system to support the diffusion of innovation. Applying new approaches to supporting student success depends upon our collective ability to find common ways to articulate the shared benefits of using data to help students better navigate their educational experiences, and to obtain essential support at points and times of need. This article also explores the value and impact that using common data definitions and frameworks to organize information generally available at post-secondary institutions brings for sharing results. Those results may help with both generalizability of research and strategies for adoption that help bring data-driven innovation to all members of the college community.

In the sections that follow, the Predictive Analytics Reporting (PAR) framework is introduced and its creation and dissemination of common data definitions and a shared structure for inventorying and testing student success interventions are discussed. Descriptions of how common frameworks can inform the scaling of findings cross-institutionally with specific examples from PAR research, and a general discussion of how PAR tools can be used is included. Finally, observations on what PAR can tell us about the adoption of a disruptive technology are shared.

## Improving Student Success

Nationally, colleges and universities struggle to improve student success; improvements have been especially challenging for realizing improvements with the lowest socioeconomic groups (Shapiro et al., 2014). Demands for improvement have resulted in a stronger focus on exploring student outcomes, including college completion. The scrutiny of outcomes has contributed to both an expanding market for educational technology that addresses outcome issues, and the internal institutional drive to innovate in the area of support for student success. These two trends set the stage for institutions to leverage academic and learning analytics (Norris & Baer, 2013). The educational technology marketplace responded by creating tools, products, and services designed to serve the needs of individual institutions.

A different approach to improving innovation to optimize student success is to work through a community of practice. The Predictive Analytics Reporting (PAR) Framework was a project originally funded by the Bill & Melinda Gates Foundation and guided by a management team from the Western Interstate Commission for Higher Education (WICHE) Cooperative for Educational Technologies (WCET) (Ice et al., 2012). The PAR Framework later became a nonprofit, multi-institutional collaborative that provided member institutions with tools and resources for identifying risks and improving student success. The assets of the not-for-profit PAR Framework were acquired by Hobsons in 2016, with the intention of continuing to support member-driven collaborations that help institutions and systems through the combined power of a collective dataset, analytic tools to improve member metrics, and research-based approaches to identifying student success interventions.

## Common Data Definitions

The goal of the six founding institutions that participated in the original PAR Framework discussions was to demonstrate that it was possible to use predictive analytics to find students at risk of dropping out of college. To do this work, the PAR Framework created a single, federated, cross-institutional dataset to investigate factors affecting the retention and progression of undergraduate students. The creation of such a common dataset clearly required the creation of common data definitions that were specific enough to ensure reliable findings but that could also be applied to most undergraduate programs. The original six participating institutions included a community college, 4-year college, university system, community college system, and two for-profit universities, which met to establish common ground for all members of the post-secondary community to engage in a common conversation. All the participating members offered both fully on-ground and fully online classes. Participating programs ranged from traditional semester terms to eight- and five-week terms with start dates happening every week. Thus, the initial work of the collaborative was to find ways of defining such seemingly simple outcome variables as *retention* and *progression* relative to a common time frame, something with which the Federal government continues to struggle. Table 1 presents categories of input variables defined.

Common definitions are a key feature of the PAR dataset. Through the original grant work, a group of researchers identified and then openly published a set of common data definitions ([https://community.datacookbook.com/public/institutions/par](https://community.datacookbook.com/public/institutions/par)). Because all of the data that were and are provided by PAR member institutions utilize these common definitions, cross-institutional *apples to apples* analyses on the combined dataset can be performed to better understand the factors that impact student success generally as well as locally.

The success of these original PAR researchers was due, in a large part, to their willingness to collaborate and share data and analytic approaches in a safe, supportive environment, a benefit that continues today. PAR member institutions comprise a range of the many diverse options for post-secondary education, including traditional, open admission community colleges; 4-year, traditional, selective admission, public institutions; and nontraditional, open admission, primarily online institutions, both for-profit and nonprofit.

Since all of the data provided by PAR member institutions meet the parameters of the common definitions, PAR researchers were able to do both aggregated and cross-institutional comparisons and analyses on the combined data. Having relatively comprehensive, detailed data for all credential-seeking students (as opposed to a sample from each institution) creates a more accurate understanding of the student- and institutional-level factors that impact risk and success. It also makes it possible to more effectively control for confounding variables that might be contributing to observed differences between student groups.

The PAR Framework data modeling yielded positive, negative, and variable predictors for being retained after 12 months. The positive predictors included high school GPA (when available), dual enrollment (high school/college), prior college credits, community college GPA, successful course comple-

Table 1. *Common Input Variables Explicitly Defined by PAR Researchers*

| Student demographics | Course information | Course catalog | Lookup tables | Student financials | Student academic progress |
|---|---|---|---|---|---|
| Gender | Course location | Subject | Credentials offered | FAFSA on file | Current major/ CIP |
| Race | Subject | Course number | Course enrollment periods | FAFSA file date | Earned credential/CIP |
| Prior credits | Course number | Subject (long) | Student types | Pell received/ awarded | |
| Zip code | Section | Course title | Instructor status | Pell date | |
| High school information | Start/end date | Course description | Delivery modes | | |
| Transfer GPA | Initial grade/final grade | Credit range | Grade codes | | |
| Student type | Delivery mode | | Institution characteristics | | |
| | Instructor status | | | | |
| | Course credit | | | | |

tion, completed developmental education courses, and credit ratio, a progression measure consisting of the number of credits successfully completed divided by the number of credits attempted. The negative predictors included withdrawals and a low number of credits attempted. Finally, the predictors that varied from positive to negative depending on institution included: Pell grant eligibility (low income), enrollment in developmental education courses, age, fully online status, and race.

## Student Success Matrix

Building on these findings, the data scientists worked with educational practitioners (i.e. implementers) to move the innovative findings from theoretical information to a framework that supported acting on analytic evidence from the dataset. The education theorists played a critical role of tying the data science innovations to what was known about student success. Researchers within the PAR community began to explore whether the PAR dataset could be extrapolated to create an updated model for retention and progression. In reviewing seminal retention studies including Tinto (1987), Bean and Metzner (1985), and Falcone (2011), the researchers developed an updated PAR model of retention as shown in Figure 2 below.

Based on these initial findings and the research literature, the PAR model (Daston, James, & Swan, 2015) shown in Figure 2 begins with *learner characteristics*, the relatively consistent attributes students bring to the learning experience. It views these characteristics as being filtered through *instructor behaviors* in the courses they take, the characteristics of those courses themselves (*course characteristics*), and *other supports*, supports not aimed at specific parts of the model, most importantly financial aid. These influence learners' feelings of *FIT* or academic and psycho-

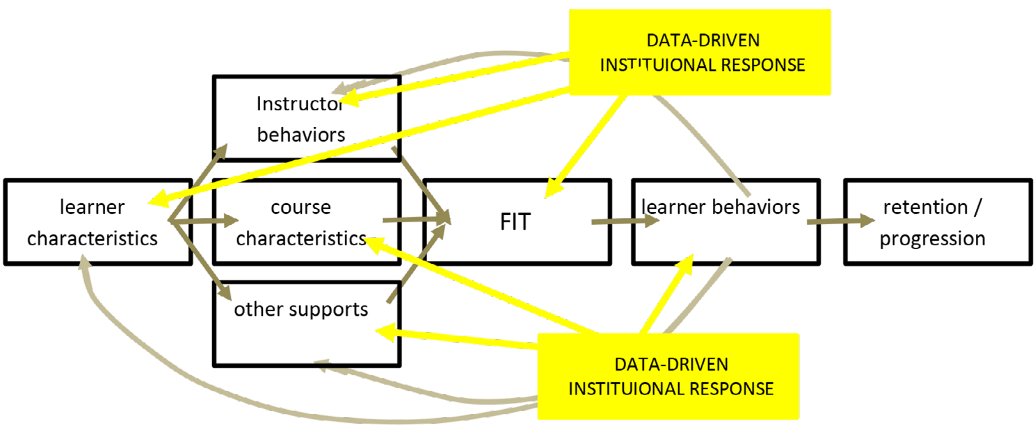


*Figure 2.* PAR Model of Factors Affecting Student Retention and Progression

social integration, which in turn affects how the learners behave in their courses and programs (*learner behaviors*), including their decisions to continue their studies (*retention/progression*). The model also shows *learner behaviors* feedback to impact the factors contributing to them and suggests where data-driven interventions might address these specific categories of what the model views as predictors of retention and progression.

In a process similar to that involved in the creation of the data definitions, PAR researchers classified interventions by the predictors identified in the research as affecting student success. The review of the literature used to substantiate the new framework also revealed that, previously, student interventions were often classified by administrative functions. The ability to identify predictors offers an opportunity to apply a community of practice process to the collection of actionable student interventions. The multi-member educational community once again agreed to an open research process that resulted in a common framework. The framework was based on the updated model of retention, predictors from the dataset, and the recognition of a student life cycle during which particular interventions might be more or less effective at different times. The student life cycle periods (see Table 2) that were identified included: *connection*, the period from when a student first contacts the institution, through admissions and initial advising until they first take classes; *entry*, the first year or so of classes when students get most of their general education courses taken and, if they have not already, decided on a major; *progress*, the major period of progression toward a degree; and *completion*, when students finish up the requirements of their degree and make plans for employment or further studies.

Table 2 illustrates how the combination of predictors addressed and stage in the students' academic life cycle resulted in the creation of the Student Success Matrix ($SSM^X$) (Wagner, Daston, Shea, Sloan, & Swan, 2013). The $SSM^X$ provides an efficient structure for inventorying, organizing, and conceptualizing supports aimed at improving student outcomes. An exploratory research process was used to test whether interventions would fit into these categories. In 2012, the 16 then-members of PAR were asked to submit on a spreadsheet the interventions that were used at their institution. The collection yielded over 1,000 interventions, all of which fit into the intervention categories (Swan & Daston, 2014). The PAR team has since refined and automated the intake process and interventions are now collected online. Using the $SSM^X$, member institutions have contributed descriptions of supports currently in use on their campuses including pro-

Table 2. *Predictor Categories by Stage in Academic Career Instantiated in the Student Success Matrix*

| | Connection | Entry | Progress | Completion |
|---|---|---|---|---|
| Learner characteristics | | | | |
| Learner behaviors | | | | |
| FIT (academic and psychosocial integration) | | | | |
| Other support | | | | |
| Course/program characteristics | | | | |
| Instructor behaviors | | | | |

grams, services, actions, interventions, and policies. The common structure in SSM$^X$ for categorizing interventions makes it possible to link them to participating students, and through the PAR dataset explore their efficacy. By providing common predictors to classify interventions across institutions, particularly effective approaches can be identified and shared among PAR institutions, paving the way for better understanding, measuring, and scaling the highest impact tools for improving student outcomes.

## Looking for Scale within the Dataset

The combination of a commonly defined dataset and a common framework to measure interventions provides powerful information for institutions to identify potential challenges or opportunities to improve student outcomes. Since the dataset and common framework is shared by all PAR Framework members, the opportunity to have a broader discussion with other community members who experience similar challenges can start immediately. The ability to measure across this continuum of universities allows data scientists and researchers to identify whether challenges are unique or shared by members. The notion of achieving scale across the industry is tantalizing and can be equated to finding generalizability in research. The dataset allows PAR data scientists and community researchers an opportunity to explore important research questions. To date, analyses have been completed on whether there is generalizability of positive predictors of success across multiple institutions' transfer students, what the PAR Framework dataset tells us about post-traditional students, and whether taking online classes is detrimental to retention and progression.

## Are the Predictors of Successful Transfer Students the Same at Multiple Institutions?

One of the analyses performed by PAR Framework researchers involved identifying similar predictors of transfer student success across institutions. One institution, University of Maryland University College (UMUC), conducted a research study that found both positive and negative predictors for transfer students. In order to replicate the study, an institution or system needed to report data on transfer students. The University of Hawaii system dataset included students who transferred from community colleges to 4-year universities. The PAR Framework data scientist looked at 18 variables at both institutions to address the research questions. Since the variables were comparable because of shared common data definitions, the research could proceed.

There were three variables that predicted a student's grade point average at the bachelor's level that were shared at both institutions (James, 2015) including:

- Did the student complete his or her

math requirement?

- Did the student earn an associate's degree?
- Did the student repeat a course?

Completion of a math course at a community college was positively associated with earning a GPA over 2.0, as was earning an associate's degree before transferring and having a higher GPA at the Community College. Repeating a course in community college was negatively associated with first-term GPA at a 4-year university. The dataset was able to reveal that each institution had unique predictors as well.

The analysis also included determining whether predictors were the same at the two institutions for retention. Retention was defined as whether the students were still enrolled between 6 and 12 months after they first enrolled. Only four variables were found to be positive predictors at both institutions. The variables in common that predicted student success included the number of credits attempted during the first term at the 4-year institution, the grade point average of the first term at the 4-year institution, the number of credits taken and successfully completed (credit ratio), and whether the course was online or face to face. Each institution also found unique positive predictors among its students.

The ability to apply results from one research study based on a local sample to a larger, national population has traditionally been compromised by limited generalizability. The PAR Framework's common data definitions provided the means for validating the results of research conducted at one institution with results from another institution.

## Getting to know post-traditional students

The PAR data science team explored the dataset and reviewed the literature to better understand post-traditional students (Watt & Wagner, 2016). What it is clear, nationwide, is that this student segment is growing. Current data-gathering practices, whether in federal requirements, state assessments, or most recruitment surveys, continue to rely on the first-time, full-time cohort. Assessment of post-traditional students leads to many related concerns for today's higher education ecosystem. For example, students who vary from the traditional path are not eligible for many federal financial aid programs, or they find that the aid they do receive is not flexible enough to work with their enrollment plans.

Such antiquated practices do a disservice to institutions that focus on recruiting, educating, and graduating post-traditional students. Similarly, if more *traditional* institutions were required to report on post-traditional student outcomes, they might alter their student success practices to be more inclusive. The common dataset at PAR offers member institutions an opportunity to investigate whether post-traditional students are similar throughout the membership. Identification of whether the data on this student segment are similar or unique to an institution is another example of how open and common data definitions support scalable research.

## A little online learning is a good thing

James, Swan, and Daston (2016) used a large dataset compiled within the Predictive Analytics Reporting (PAR) Framework to compare students taking only on-ground courses, students taking only online courses, and students taking a mixture of both at five primarily on-ground community colleges, five primarily on-ground 4-year universities, and four primarily online institutions. Their work suggests that online courses can provide both flexibility and access while improving student completion.

The results suggest that taking online courses is not necessarily harmful to students' chances of being retained. While the PAR Framework dataset represents a microcosm of institutions across American universities, it does include a more representative sample of institutions serving nontraditional students. It is clear from other work, including recent reports from the Integrated Post-Secondary Education Data System (IPEDS), that these students are taking more accessible course modalities like online and blended courses. James and colleagues' (2015) research reveals essentially no difference in retention between delivery modes for students enrolled in primarily on-ground 4-year universities participating in the PAR Framework. At participating primarily online institutions, students taking both online and on-ground courses had slightly better odds of being retained than students taking exclusively on-ground or exclusively online courses. The same was true of students at primarily on-ground PAR community colleges. Only at these latter institutions did taking online courses negatively impact success, and that was when only online courses were taken.

## Examples of Student Success Interventions using the Common PAR Framework

Building on the common approach to identify trends and to investigate research questions within the PAR dataset, the SSM$^X$ is used to categorize interventions across institutions. When the SSM$^X$ and analyses involving the PAR datasets are combined, the results can help to identify particularly important interventions. The information can then be shared among PAR institutions, paving the way for better understanding, measuring, and scaling the highest impact tools for improving student outcomes. This approach differs from the comparison institutions might do when exploring other reported data. Other sources of data are not easily connected to ongoing student success interventions. There is scant evidence showing that institutions catalog their interventions at all. SSM$^X$ helps an institution commence the laborious process of inventorying student interventions. Institutions can then assess whether any given intervention improves student outcomes.

The benefit of grounding student success efforts in analytics is the opportunity to test whether a particular intervention or set of interventions improves student outcomes. Using the SSM$^{X}$, institutions can enter interventions, link them to participating students, and then measure whether a change in outcomes occurred. When an institution joins PAR, it can compare its data to other peers' benchmarks and immediately discuss with those peers interventions they may be using to address challenges. Members of PAR also include statewide systems that can benchmark their progress within the state. By choosing a system that is built on a common set of definitions and a research-based framework, institutions can measure progress both internally and externally. In addition to the progress being measured, PAR membership also creates community-driven discussions around interventions which are invaluable.

The process of collecting interventions also allows institutions and communities of institutions to look for gaps or redundancy in services. Academics report regularly on different interventions launched and progress made, but few institutions report intra-institutional data collection and comparison and even fewer report interventions that are compared against peer institutions. By recording the institution's interventions, student success staffs have a comprehensive view across all units responsible for interventions.

Multiple institutions within the PAR community have expressed surprise at the number of student interventions offered across their campuses. The collection process often led them to review interventions in a more systematic way. These institutions report asking questions such as:

- Do we have data to support the effectiveness of the intervention?
- If the intervention has been practiced over multiple years, has the impact on the intended population been determined and did it change over the years?
- Do we know the cost of the intervention?
- Are we aligning interventions to our greatest student retention challenges?

This introspective reviewing process is important. Among a community of institutions, it leads to the sharing of insights, interventions, and retention challenges.

The community sharing then leads to collaboration. Within the PAR community, members have identified similar challenges and agreed to try similar interventions and report the findings from researching the effects of the interventions. The PAR Framework tools, such as Obstacle Course Explorer, allow institutions to identify courses where course completion could be improved. Obstacle courses are those courses where the data show that if students do not complete the course with a C or better grade, then the course serves as a barrier to retention and progression. The SSM$^{X}$ tool can help align an intervention to obstacle course improvements. The combination of data and targeted interventions can then be shared with other members to determine whether colleagues are using similar interventions.

The PAR data team explored obstacle courses that had particularly high fail rates. Several universities recognized that their beginning accounting courses were all part of the dataset and that these courses were particularly concerning as they had both high enrollment and high fail rates, and were often damaging to progression because they were prerequisites for other courses. After a review of research on improving accounting course outcomes and a discussion with faculty, administrators, and student services support staff, the institutions decided to intervene by adding peer mentoring or embedded tutoring to certain accounting sections. Each institution ran their own tests, but continued to share with each other the results including how to improve the intervention if it was iterated. Although a cross-institutional study was discussed, it was not pursued. While an iterative scale was not realized, cross-institutional practices were shared and disseminated.

As referenced earlier, PAR members include several state systems. The state systems have promoted an evidenced-based culture and are leveraging the SSM$^{X}$ to review interventions that could specifically improve statewide student outcomes. The University System of Maryland (USM) adopted the PAR Framework as part of a system-wide effort to optimize investments aimed at improving student success. All USM institutions will adopt the PAR Framework Student Success Matrix (SSM$^{X}$) in order to inventory, categorize, and explore the returns on investment for student success programs deployed at each institution. The intervention measurement focus of this initiative targets innovative student supports and interventions used by institutions with their students. The effort to categorize interventions and improve outcomes is part of an active commitment to improve graduation rates to 55% for students entering 4-year institutions. USM will look for opportunities to impact academic outcomes and identify interventions across the academic life cycle where academic advisors have the potential to identify struggling students at optimal points and in times of need. The collaborative nature of identifying statewide student success interventions speeds up the dissemination of practices that work.

The early examples of the SSM$^{X}$ begin intervention measurement. If the measurement indicates that an intervention is successful, the stage is set for that intervention to be adopted by other institutions facing similar challenges. Since members of the PAR Framework have access to their data, they can measure the impact of the intervention to see if a successful intervention is scalable across institutions. The alignment of common data definitions with a common framework for intervention measurement sets the stage for adoption of effective interventions that can be scaled across a community.

## Conclusions

Adopting better student success strategies is dependent on having good data and educational technology to support better decision making. The PAR Framework relies on a community approach to the development of common data definitions and an organizing framework that identifies and categorizes student success interventions. The innovation surrounding the PAR Framework is not only the data science, even though many in the field would equate educational analytics to a powerful innovation (Dunbar, Dingell, & Prat-Resina, 2014). The power lies in the combination of an innovation within a community that is capable of implementing and diffusing the innovation. The common data definitions and framework clearly set the stage for scaling of successful strategies. The development of open tools for student success research promotes innovation among a community of educational practitioners (i.e. implementers). The community-based approach connects high-priority issues of student success to the development of innovations within the analytics tools.

Predictive analytics experts have the power to evaluate data on specific variables to yield answers related to improving student success. Research across the learning analytics community strongly suggests that institutions can now avail themselves of better student success information including information about students across multiple groups, such as veterans, transfers, and even stop-outs. It would be beneficial to the higher education community to understand where there are commonalities across the student ecosystem, where small changes lead to big differences, and where niche programs may be best. We may even learn that our populations perform better overall when we consider post-traditional student needs. With evidence comes the ability to focus solutions, and dollars, where they will make a difference.

The PAR Framework tools can be used to internally analyze predictors of student success and the effectiveness of student success interventions, as well as support external collaboration with others. External collaboration assists with the dissemination of best practices in a way that internal analyses cannot (Stiglitz & Greenwald, 2014). Achieving a balance of innovation and implementation that promotes both internal introspection and external collaboration offers the community a better way to innovate in the important area of student success.

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# Constructivist Teaching Patterns and Student Interactions

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Abstract

*The constructivist learning theory, which refers to the idea that learners construct knowledge for themselves, can have a positive impact on online-learning environments when focusing on adult learners. Within this constructivist learning environment, we are able to create a place where learners can work together and support each other as they use a variety of tools and information resources in their pursuit of learning goals and problem-solving activities. This article presents information about constructivism as a learning theory, constructivist teaching, and the formation of a learning environment that promotes meaningful and authentic activities that help learners develop skills relevant to problem-solving as opposed to merely navigating a strictly instructional environment. While there are several ways to apply constructivism in the online classroom, here we explore five simple, easy-to-use constructivist-based teaching methods with real-classroom examples that include interactive learning, facilitative learning, authentic learning, learner-centered learning, and high-quality learning.*

***Keywords:*** *constructivist teaching, student interaction, online learning, constructivism, interactive learning, facilitative learning, authentic learning, learner-centered learning, high-quality learning, jigsaw*

## Introduction

Although its roots date back to the 1930s, constructivism as an educational philosophy really did not become prominent until the early 1990s. There were five basic principles identified in the research conducted at that time (Dunlap & Grabinger, 1996; Savery & Duffy, 1996). These principles include: (1) learning is an active process of meaning-making gained from our experiences and interactions with the world; (2) learning opportunities arise as people encounter situations that involve cognitive conflict, challenge, and


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through planned problem-solving; (3) learning is a social activity which involves acts of collaboration, negotiation, and participation; (4) reflection, assessment, and feedback are embedded within learning activities; and (5) learners take primary responsibility for their learning.

In its most basic sense, the constructivist model of learning posits learning as a process of constructing or making something. The premise of the model is that people learn by making sense out of the world. In other words, they make meaning out of what they encounter. As mentioned, the essence of constructivism is that students actively construct knowledge. Ultimately, constructivism is the philosophical and scientific position that knowledge arises through a process of active construction (Mascolo & Fischer, 2010). The core element of this assumption is that learners interpret new information using knowledge that they have already acquired. Learners activate prior knowledge and try to relate new information to knowledge they already possess. By doing so, understanding subject matter is a function of knowledge construction and transformation, not merely information acquisition and accumulation (Blumenfeld, 1992).

## A Constructivist Learning Environment

The notion that students control their learning is at the heart of the constructivist approach to education. Therefore, it is imperative that we develop classroom practices and deliver the curriculum to enhance the likelihood of student learning. However, controlling what students learn is nearly impossible. The search for meaning takes a different route for each student. As educators we have great control over what we teach, but far less control over what students learn (Brooks & Brooks, 1999). Even when we structure classroom lessons and curriculum to ensure that all students learn the same concepts at the same time, each student still constructs his or her own unique meaning through his or her own cognitive processes.

The search for understanding motivates students to learn. When students want to know more about an idea, or a topic, they put more cognitive energy into classroom investigations and discussions and study more on their own (Canestrari & Marlowe, 2013). As educators, priorities of ensuring that all students learn the same concepts, we carefully analyze students' understandings, and customize our teaching approaches are essential steps of educational reform that should result in increased learning. But these priorities require a paradigm shift.

Brooks and Brooks (1993) identified five central tenets of constructivist teaching, which parallel the five principles of constructivism. The first is that constructivist teachers seek and value students' points of view. Secondly, constructivist teachers structure lessons to challenge students' suppositions. When educators permit students to construct knowledge that challenges their current suppositions, learning occurs. Third, constructivist teachers recognize that students must attach relevance to the content and curriculum. As students see relevance in assigned activities, their interest in learning grows. Fourth, constructivist teachers structure lessons around big ideas, not small bits of information. Finally, constructivist teachers assess student learning in the context of daily classroom investigations. Students should demonstrate their knowledge every day in a variety of ways.

## Promoting Meaningful and Authentic Learning

Learning is considered meaningful when it is generalizable, functional, and durable (Zitter, De Bruijn, Simons, & Cate, 2011). Generalizable refers to learning that is associated with different contexts, situations, and tasks. Functional learning is learning that makes us act differently. Last, durable means that learning is recorded in our long-term memory and we can access it at any time.

It is important that teaching based on these ideas involves understanding two key characteristics of the learning process: (1) durable learning is only possible when attention, practice, and repetition are united; and (2) all things learned are either associated with the subject, the tasks, the interaction with others, or the physical setting where they have been taught. The further transfer of this knowledge to other subjects, tasks, interactions or spaces is not achieved spontaneously and must be taught (Vandekar, 2015). The onus is on the educator to create and facilitate learning experiences that attend to these notions.

Authentic learning has also been referred to as real-life learning. Instead of vicariously discussing topics and regurgitating information in a traditional industrial age modality, authentic learning engages all of the senses and encourages learners to create tangible, useful products worth sharing with their community. Once an educator provides a motivational challenge, he or she must nurture and provide the necessary criteria, planning, timelines, resources and support to accommodate this kind of student success. The teacher becomes a guide on the side or an event manager: a facilitator not a dictator. Facilitated processes become the predominant force while assignments are real-life or simulated tasks that provide learners with opportunities to connect directly with the real world beyond the classroom.

## Constructivism in the Online Learning Environment

The online learning modality offers an abundance of unique opportunities for constructivist teaching and learning methods. A common struggle with online instruction is keeping students engaged in what they are learning in an online (often asynchronous) platform rather than a traditional face-to-face (synchronous) class setting (Carwile, 2007). While it is important to provide students with ways to stay engaged with the material, this can be a challenge.

The use of constructivist learning techniques and activities naturally engages the receptive online student differently than with objective learning. Woolfolk (1993, as cited in Koohang, Riley, Smith, & Schreurs, 2009) states, "the key idea is that students actively construct their own knowledge: the mind of the student mediates input from the outside world to determine what the student will learn. Learning is active mental work, not passive reception of teaching" (p. 92). But quite often, in constructivist learning, students are interpreting and processing the constructs and world views of their peers, especially in face-to-face classrooms. Learning online can be particularly advantageous, deep and meaningful to students as they process their own constructs of new knowledge at their own more personalized pace.

## Easy-to-Use Constructivist-Based Teaching Methods

As aforementioned, there are five simple, easy-to-use constructivist-based teaching methods, which include interactive learning, facilitative learning, authentic learning, learner-centered learning, and high-quality learning. There are a number of unique ways of applying constructivist teaching in a course with an online student population.

One way to apply constructivist teaching to a course is by way of the *jigsaw* technique. The jigsaw method is the division of students into several groups where each group is assigned the same general topic, but assigned a different aspect of that topic. By assigning the same general topic, along with different subtopics, different perspectives can be explored (Media Merge—Teachers' Toolbox, n.d.). For example, if students are studying the topic of adolescence in an Introduction to Lifespan Development course, they can be divided into three groups where each group is, respectively, assigned the following: socio-emotional aspects of adolescence, physical aspects of adolescence, and intellectual/cognitive aspects of adolescence. The groups can research and analyze their topics, discuss subtopics asynchronously in a discussion forum, or synchronously via Skype or FaceTime chats, and then reconvene together as one larger group to collaborate and synthesize the material from multiple perspectives. This prompts a discussion of the similarities and differences of the content, leaving a meaningful and lasting learning experience (Koohang et al., 2009). The Jigsaw method and methods similar to it can provide a highly collaborative activity that offers a deep and lasting retention of the material (Schell & Jann, 2013). Accountability is inherently built in as each small group member must become an expert on the subtopic, or aspect, in order to have larger class discussions with others. The group members become experts on the assigned or selected aspect and have a stronger anchor to which connect information about the other aspects.

Another method of applying

constructivist-based teaching to a course is to utilize peer learning, which simply refers to *learn by teaching*, where the students are learning from their peers and also by teaching their peers (Shultz, Ballard, & Hemerda, 2015). The peer learning approach is broad and can take many forms as a teaching and learning method, but a simple and effective way is to work with an open-ended discussion question that applies high-level Bloom's Taxonomy (i.e. evaluate, synthesize, etc.) to create a forum where the material can be applied (Media Merge—Teachers' Toolbox, n.d.). For example, have students in an abnormal psychology course studying the topic of personality disorders to each choose one of the 10 personality disorders listed in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) and *teach* others what they learned and share their perspectives and thoughts on the etiology, diagnosis, treatment, etc. Students can include a character from a book or movie displaying traits of the personality that they selected and *teach* their peers what brought them to this conclusion, thus applying the material. This method can promote a high-quality and engaging activity for learners.

Providing presentation opportunities that allow students to *apply* learning is a deep and meaningful way for mastering and understanding the material (Koyanagi, n.d., as cited in, Carwile, 2007). One example requires students to conduct informational interviews with professionals in their chosen career fields. Then, students report back with presentations on what they learned during the interview process. They should include discussing any pre- and post-interview research they conducted.

Finally, another simple way to apply constructivist learning opportunities in a class is through *self-checks* that are correctable in the online course room. Students can identify and fix their errors independently (Media Merge—Teachers' Toolbox, n.d.) and become more self-sufficient and empowered learners. There are a myriad of other ways that students can learn through authentic, constructivist activities that help them develop skills relevant to problem-solving as opposed to merely functioning in a strictly instructional-focused environment.

## Conclusion

In much of the literature, the use of constructivist teaching approaches in the learning environment is geared toward children. However, there is overlap with pedagogy and andragogy. Clearly, constructivist teaching patterns can be applied at the post-secondary level as well. When adults experience the same book or movie, and are asked to describe it, they will certainly come up with very different conceptions. When we ask adults about the meanings of concepts in general, very different constructs will be evident. In other words, we all construct our own meanings in individualized ways. In online classrooms, educators can leverage this and use teaching methods, as described above. Doing so, helps to elicit interpretation of the material being studied, and allows "the learner and the teacher to detect misconceptions, errors, and omissions in learning and correct these" (Petty, n.d., p. 1). As aforementioned, this premise of the model is that people learn by making sense out of the world; they make meaning out of what they encounter. The essence of constructivism is that students actively construct knowledge.

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# Immersive Technology: Motivational Reactions from Preservice Teachers

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Abstract

*Within teacher education, there is limited literature on the use of contemporary immersive technologies with preservice teachers. This study describes the instructional design of an online, immersive technology module taught to undergraduate, preservice teachers (N = 27), and discusses preservice teachers' reactions to creating and interfacing with immersive technology. The online module was designed using strategies from the Attention, Relevance, Confidence and Satisfaction (ARCS) motivational design model. Data were collected using the Instructional Materials Motivation Survey. Participants thought the module contained content that was worth knowing, and was relevant to their needs and interests. Participants reported that the module impacted their interest to consider immersive technology with their own future instructional design. The results of this study shed light on new opportunities for teacher educators to become familiar with immersive technologies and suggest that such tools should be integrated into teacher preparation curricula.*

***Keywords:*** *ARCS, immersive technology, IMMS, motivation, preservice teachers, teacher preparation, virtual reality*

## Introduction

The application of immersive technology is common in the areas of aviation, business, military, and medicine, but it is limited and slowly emerging in the field of teacher education (Dieker, Rodrigues, Lignugaris/Kraft, Hynes, & Hughes, 2014) and educational settings (Dawley & Dede, 2014). The 2017 Higher Education Edition of the Horizon Report discusses technology developments that have the potential to foster real changes in education, particularly in the development of progressive pedagogies and learning strategies and the arrangement and delivery of content (Adams Becker et al., 2017). The Horizon Report noted that immersive technology, such as virtual reality, has the potential to add more functionality and greater potential for learning (Adams Becker et al., 2017).

Immersive technology, defined


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herein as augmented, virtual, and 3-D reality, refers to all forms of perceptual (input to the user) and interactive (output from the user) hardware technologies that blur the line between the physical world and the simulated or digital world (Mahomedy, 2015). Immersive technology simulates a subjective impression that allows users to participate in a comprehensive, realistic, participatory experience (Dede, 2009b). Immersive technology often contains a variety of features such as 3-D display and audio effects not possible in the real world to enhance users' engagement and learning within an experiential simulation (Dawley & Dede, 2014). When high levels of engagement occur with technology, the user believes he or she is in the environment physically and cognitively (Dede, 2009b).

Libraries today on university and college campuses are expanding their information and technology resources to include cutting-edge tools such as virtual reality equipment and 3-D printers. Immersive technology has also been identified as an important technology development that could support innovation and change in K-12 classrooms (Adams Becker et al., 2017).

In 2015, schools in Australia, Brazil, New Zealand, the United Kingdom, and the United States began collaborating with Google to beta-test Expeditions. Expeditions are collections of virtual reality content and supporting materials that can be used alongside an existing curriculum (Google Expeditions, 2017). Google Expeditions enable teachers to bring students on virtual trips to museums, historical monuments, and outer space. The beta Expeditions program enabled one million students in 11 countries to participate in virtual field trips. It is predicted that virtual reality will be widely adopted by schools within 2–3 years. It is also estimated that by 2025, the market for virtual reality content on Smartphone devices will reach $5.4 billion, virtual and augmented reality entertainment revenue will reach $3.2 billion, and the education sector will attract 15 million users (Adams Becker et al., 2017).

Despite the proliferation of modern immersive technology, typical classrooms seldom leverage immersive technology for teaching and learning (Dunleavy, Dede, & Mitchell, 2009). If K-12 teachers should be more skilled at using approaches that encourage their students to engage with academic content, an obvious place to begin and experience new ways of teaching and learning, such as using immersive technology, is in teacher preparation programs (Hoban, Loughran, & Nielson, 2011).

Due to the lack of immersive technology usability in teacher education (Dieker et al., 2013), the impetus for this study was wanting to know if a module on immersive technology would capture preservice teachers' attention and interest and appear important enough to integrate into teacher preparation program curricula. This study describes the instructional design of an online, immersive technology module taught to undergraduate, preservice teachers, and discusses preservice teachers' reactions to creating and interfacing with immersive technology.

Reactions from preservice teachers were measured using the Instructional Materials Motivation Survey (IMMS) (Keller, 2010). Technologies used to measure preservice teachers' reactions to the immersive technology module included augmented and virtual reality apps, social media such as Twitter and Pinterest, and 3-D lesson building software. The research question that guided this study was *what are the motivational reactions from undergraduate preservice teachers to enhanced, online, immersive technology instructional materials*? Preservice teachers in this study refer to undergraduate students enrolled in a teacher preparation program.

## Literature Review

While recent attention has focused on new opportunities of immersive technology, the affordances of educational integration of virtual reality have been explored for decades, dating back to its general inception of integration by Ivan Sutherland in the 1960s (Dede, 2009a). Immersive environments shape users' learning styles, strengths, and preferences (Dunleavy et al., 2009). Immersive interfaces can aid in designing educational experiences that build on students' digital fluency to promote engagement, motivation, learning, and transfer from classroom to real-world settings (Dede, 2009b). The more an immersive experience is based on design strategies that combine actional, symbolic, and sensory factors, the greater the participant's suspension of disbelief that she or he is *inside* a digitally enhanced setting (Dede, 2009b).

Salzman, Dede, Loftin, and Chen (1999) discuss educational environments with virtual reality and conceptual learning and write,

> If properly designed, 3-D, multisensory virtual worlds might be able to aid users in comprehending abstract information by enabling them to rely on their biologically innate ability to make sense of physical space and perceptual phenomena ... By engaging users in learning activities, immersion may make important concepts and relationships more salient and memorable, helping users to build more accurate mental models. Also, inside a head-mounted display, the user's attention is focused on the virtual environment without the distractions presented in many other types of educational environments. (p. 294)

In the past several years, the utility of various elements of immersive technology in education has been discussed, from broad overviews of applications (Wu, Lee, Chang, & Liang, 2013) and overviews in teacher education (Aldosemani & Shepherd, 2014; Gregory & Masters, 2012) to specific cases such as environmental field trips (Dunleavy et al., 2009) and the use of Second Life in higher education (Warburton, 2009). Second Life is the most mature and popular multi-user virtual world platform used in education. Researchers have also investigated the affordances and constraints of augmented reality in mathematics and geometry education (Kaufmann, Schmalstieg, & Wagner, 2000), immersive virtual technology as a basic research tool in psychology (Loomis, Blascovich, & Beall, 1999), and immersive virtual reality to learn science (Bailenson et al., 2008; Dede, & Barab, 2009; Ketelhut, Nelson, Clarke, & Dede, 2010).

Empirical research on immersive technology has produced positive results. In a systematic review of literature on immersive virtual worlds in K-12 and higher education settings, Hew and Cheung (2010) examined literature on the usage of virtual worlds by students and teachers, the research methods used to study immersive virtual worlds, and the research topics conducted on virtual worlds in teaching and learning. Hew and Cheung found that virtual worlds were utilized for communication spaces, simulation of space (spatial), and experimental spaces. Most studies, 14 out of 15, were descriptive in nature and conducted in polytechnic and university settings. Research topics conducted on virtual worlds included participants' affective domain, learning outcomes, and social interaction. Hew and Cheung reported that students like using virtual worlds because they enjoy the ability to move around freely in a 3-D space, to meet new people, and to experience virtual field trips and simulated experiences.

Literature reviewed by Hew and Cheung (2010) also suggested that the use of avatars in virtual worlds could help foster social interaction among participants. For example, Bailey and Moar (2001) found avatars were the main means for elementary students in the United Kingdom to initiate contact and conversation with others. Students spent ample time searching for other people, and looked forward to meeting students from other schools. Peterson (2006) reported that the use of avatars by students of English as a foreign language in Japan contributed to a sense of being there within virtual world environments. The use of avatars enhanced interaction more than other chat environments.

The use of virtual reality created an interesting dynamic in Castenada and Pacampara's (2016) exploratory study on the use of virtual reality with seven teachers from six schools across the United States. Teachers and students learned alongside each other and collaboratively worked in groups to create and interact with content. Teachers used technology challenges as teachable moments and the students were enthusiastic about finding solutions to the challenges. A major finding of the study highlighted that more content is needed in order to make virtual reality a truly useful mechanism for learning in the non-tech classrooms.

Despite positive outcomes and benefits of immersive technology, Schrader (2008) warns educators that the highly dynamic and changing nature of immersive environments necessitates changes to existing instructional design strategies. Schrader writes, "teachers must accept less direct control over the instructional conditions and shift their focus and attention to the rules and constraints governing the immersive environments" (p. 469). Schrader argues this establishes a need for educators to fully understand the realities of contemporary educational contexts and emerging instructional roles.

The most recent research on immersive technologies in teacher education delves into the educational affordances and use cases with large-scale tools. One of the more well-known cases is the TLE TeachLivE™ lab, a virtual reality simulator that provides preservice teachers and in-service teachers opportunities to experience simulations of classroom experiences (Dieker, Rodriguez, Lignugaris/Kraft, Hynes, & Hughes, 2014; Dieker, Hynes, Hughes, & Smith, 2008; Myers, Starrett, Stewart, & Hansen-Thomas, 2016). The TLE Lab allows participants to learn teaching skills and craft their practice without real students present during the learning process (Dieker et al., 2014). "Unlike practice instruction in real classrooms, teachers can reenter the environment to fix errors with avatars and ensure student success" (Dieker et al., 2014, p. 30). Dieker et al. hypothesize that these processes should transfer to real classrooms when instructing real students. With more than 30 universities in the United States using the TLE TeachLivE™ lab to train preservice teachers, "the use of simulated environments is part of the evolution in teacher education being realized through emerging technologies" (Dieker et al., 2014, p.21).

Gregory and Masters' (2012) findings using Second Life with preservice teachers who performed role plays in a real-life physical setting and within the virtual world of Second Life also revealed that real-world role-plays can be simulated in a virtual world. Preservice teachers found the real-life and virtual world-based versions of the role-playing activity interesting and engaging. Students put the same amount of effort into the real-life workshops as the Second Life workshops; however, students found carrying out the activity in real-life more appealing and worthwhile than doing so in Second Life.

Gregory et al. (2011) explored the assessment of virtual professional experiences (VirtualPREX) with preservice teachers who role-played professional experiences in a virtual world. VirtualPREX was designed and implemented to provide preservice teachers with experiences that reflect the complex, diverse, multifaceted nature of a teacher's role in the classroom. Although preservice teachers found the role-play activity interesting and entertaining, and commented on the value of virtually role-playing a teacher or student, 31% of preservice teachers ($N$ = 71) found the activity confusing and only 40% found the activity useful.

## Immersive Technology and Motivation

Research indicates that the use of immersive technology results in increased student motivation. Student and teachers report high engagement as a result of using handhelds, adopting roles, negotiating meaning within active, inquiry-based compelling narratives, solving authentic problems, and physically exercising (Dunleavy & Dede, 2014). Motivation was also a key finding from Freina and Ott's (2015) review of the literature on immersive virtual reality technology in education. Freina and Ott reviewed 93 published articles between 2013 and 2015, and concluded that immersive technology increases the learner's involvement and motivation while widening the range of learning styles supported. The main motivation for virtual reality use is that it gives the opportunity to live and experiment those situations that cannot be accessed physically.

Theories about motivation from social psychology describe various reasons why participants might become highly engaged in immersive simulations and might be motivated to frequently seek out this experience (Bartle, 2003). Students are motivated by the realistic scenes, dynamic presence, and high interaction supported by immersive technology (Lee, Wong, & Fung, 2010). In immersive simulations, motivational factors that encourage a willing suspension of disbelief include empowering the participant in an experience to initiate actions that have novel, intriguing consequences, invoking powerful semantic associations and cultural archetypes via the content of an experience, and sensory immersion through extensive visual and auditory stimuli (Dawley & Dede, 2014).

Mahadzir and Phung (2013) studied augmented reality pop-up books to motivate and support students in English language learning. They developed a pop-up book that incorporated Keller's (2010) Attention, Relevance, Confidence, and Satisfaction (ARCS) motivation model, observed primary school students using the pop-up book for a year, and conducted semi-structured interview at the end of application. Mahadzir and Phung revealed that the augmented reality pop-up book contributed to "perceptual arousal, inquiry arousal, variability, goal orientation, motive matching, familiarity, learning requirements, success opportunities, personal control, intrinsic reinforcement, extrinsic rewards, and equity" (p. 34). In addition, the study found that augmented reality increased students' performance by providing a more inspiring environment for students.

Solak and Cakir's (2015) descriptive research study also investigated students' performance using immersive technology. They examined the motivational levels of 130 undergraduate students in a language classroom that utilized augmented reality. Findings revealed that augmented technology had a positive impact on increasing learners' motivation towards vocabulary learning in a language classroom. Solak and Cakir also found no statistically significant difference between genders towards motivation, and high achievers had a high level of motivation in terms of confidence and satisfaction towards the use of augmented reality in the language classroom.

Data on immersive technology

has also demonstrated an increase in engagement and motivation of students who had previously been disengaged and disinterested in school. Through interviews and observations, Dunleavy, Dede, and Mitchell (2008) documented how teachers and students describe and comprehend ways in which participating in an augmented reality simulation aids or hinders teaching and learning. Teachers reported a positive difference in the behavior and engagement of students during their use of augmented reality as compared to their normal classroom behavior. Students and teachers reported that the most motivating and/ or engaging factors of using augmented reality were using the handhelds and GPS to learn; collecting data outside; and distributed knowledge, positive interdependence, and roles.

Results from research studies using the virtual reality simulator TLE TeachLivE™ Lab in the fields of counseling, secondary science students, teacher preparation in algebra, and special education also reveal that participants were motivated to use immersive technology and felt confident in studying content while using the simulator (Andreasen & Haciomeroglu, 2009; Bousfield, Dieker, Hughes, & Hynes, 2016; Dieker, Grillo, & Ramlakan, 2011; Dieker et al., 2014; Gonzalez, 2011; Straub, Dieker, Hynes, & Hughes, n.d.; Vince-Garland, Vasquez, & Pearl, 2012). In fact, Vince-Garland et al. (2012) reported that graduate students in special education improved, on average, their performance with discrete-trials teaching, an evidence-based practice used in educational programs for children with autism spectrum disorders, from a mean accuracy of 37% to 87 after receiving coaching in the TLE TeachLivE™ virtual classroom setting.

Other forms of immersive technology such as gamification and role-play-based augmented reality have enhanced users' motivation and a sense of authenticity (Rosenbaum, Klopfer, & Perry, 2007). Gee (2003) argues that gamification can promote problem-solving, goal-related behavior, engagement, and motivation. Aspects of gamification that promote intrinsic motivation include intrapersonal factors such as challenge, control, fantasy, and curiosity as well as interpersonal factors such as competition, cooperation, and recognition (Bartle, 2003).

## Conceptual Framework

The conceptual framework that guided this study was Keller's motivational model of learning (1979). Motivation is the most frequently used explanation for success or failure in completing complex tasks and is a pivotal concept in most theories of learning (Chang & Lehman, 2002). Keller (1979) believed external conditions could be successfully constructed to facilitate and increase learner motivation. According to Keller, motivation occurs when students' curiosity is aroused and sustained; the instruction is perceived to be relevant to personal values or goals; students have the personal conviction to succeed; and the consequences of the learning experience are consistent with students' personal incentives. Based on this, Keller developed the ARCS model (Keller 1984, 1987, 1999).

The ARCS component Attention refers to gaining attention, building curiosity, and sustaining active engagement in the learning activity (Keller, 2008). In this component, it is important to use a variety of approaches to gain students' attention. According to Keller, "people adapt to routine stimuli; no matter how interesting a given technique or strategy is, they will lose interest over time. Thus, it is important to vary one's approaches and introduce changes of pace" (p. 177).

The ARCS component Relevance includes concepts and strategies that establish connections between the instructional environment, which includes content, teaching strategies and social organization, students' goals (either extrinsic or intrinsic), learning styles, and past experiences (Keller, 2008). The Relevance component has been likened to authentic learning experiences based on constructivist approaches to learning. Other motivational concepts that help explain relevance are motives such as the needs for achievement, affiliation, and power (Keller, 2008).

The ARCS component Confidence incorporates variables related to students' feelings of personal control and expectancy for success (Keller, 2008). According to Keller, "confidence is achieved by helping students build positive expectancies for success and then experience success under conditions where they attribute their accomplishments to their own abilities and efforts" rather than luck or an easy task (p. 177). The Confidence component integrates concepts from self-efficacy theory. Self-efficacy theory involves "people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives" (Bandura, 1994, para. 1). Individuals are more likely to engage in activities for which they have high self-efficacy and less likely to engage in those they do not (Van der Bijl & Shortridge-Baggett, 2002). If students expect failure, they will avoid the task. If students anticipate success, they will approach the task (Heafner, 2004).

In the ARCS component Satisfaction, it is necessary for learners to have positive feelings about their learning experiences and to develop continuing motivation to learn (Keller, 2008). "Providing students with opportunities to apply what they have learned, coupled with personal recognition, supports intrinsic feelings of satisfaction" (Keller, 2008, p. 178). Keller adds students must feel that the amount of work required by the course was appropriate; there was internal consistency between objectives, content, and tests; and there was no favoritism in grading.

In writings on the validity of the ARCS model, Keller (Keller 2008, 2010; Keller & Suzuki, 2004) often cites research from Winiecki, Fenner, and Chyung (1999) and Chang and Lehman (2002). Winiecki et al. (1999) used the ARCS model to design and implement interventions that would decrease the dropout rate in a distance-learning program. According to Keller (2008), results from the Winiecki et al. study indicated that there were improvements in both learning and motivational reactions in all four motivational components of the ARCS model. Also, there was a significant reduction in the dropout rate, from 44% to 22%.

Chang and Lehman (2002) used the ARCS model in an experimental study to investigate effects of intrinsic motivation and embedded relevance enhancement within a computer-based interactive multimedia lesson for English as foreign language learners. Results indicated that the use of relevance enhancement strategies facilitated students' language learning regardless of learners' level of intrinsic motivation, the more highly intrinsically motivated students performed better regardless of the specific treatments they received, and intrinsically motivated students who learned from the program with embedded instructional strategies performed the best overall.

Means, Jonassen, and Dwyer (1997) compared the effects of the intrinsic relevance of course material with embedded, extrinsic relevance-enhancing strategies based on the ARCS model. The results of the study indicate that the learners, 100 undergraduate students enrolled in statistics and a human physiology class, had higher perceived motivation levels and better task performance. The embedded relevance strategies, such as the use of concrete language and examples, use of imagery and analogies, use of human-interest graphics and stories, enhanced motivation and improved performance, especially for the learners for whom the materials were not relevant.

## Methods

### *Participants*

Participants included a purposeful sample of 27 undergraduate preservice teachers from a small undergraduate college in the southwest with an enrollment of approximately 6,000 students. Participants were enrolled in a lower division required educational technology course during the fall 2016 semester. The course was offered online via Canvas, the learning management system used by the college.

The course demographics included 23 female participants and 4 male participants, of which there were 6 sophomores, 15 juniors, 2 seniors, and 4 post-baccalaureate students. Participants' majors included 9 elementary education majors, 10 secondary education majors, and 6 speech pathology majors. Two participants selected "Other" as their major. Two participants were certified classroom teachers and one participant was a substitute teacher. Two participants studied and used immersive technology prior to this course. Three participants had previously used augmented, virtual reality, or 3-D with education planning and/or teaching.

### *Course Context*

Participants completed a 4-week module on immersive technology, which included assignments using immersive technologies. Keller's (1983) ARCS model was used to design and develop the module. According to Keller, the ARCS model allows faculty and designers to evaluate whether the materials created and used in a course do in fact grab a learner's attention, appear important, establish trust, and leave the learner believing that the materials conveyed what they intended to convey. From a teacher preparation perspective, the ARCS model provides an opportunity for the preservice teacher to contemplate the materials they might create in such a way that they are more conscientious about their own professional classroom competencies (Keller, 2010).

Motivational design strategies based on the ARCS model used in this study included, but were not limited to, varied positions of photos, images, text, and background colors; a navigation side panel with minimal options that were easy to locate; online tutorials for all technology utilized in the course; an "ask the professor" link that was easily accessible to students from the homepage and discussion board located in the module; technical support from the professor via the telephone and video conferencing; examples of completed assignments; online resources such as a list of free apps; opportunities for students to work at their own pace with all tutorials and course resources such as podcasts and PowerPoint slides; use of positive, encouraging, congratulatory language with feedback and responses to questions; use of animations to bring attention to important information; and enlarged text and colorful font to highlight key concepts. These strategies are designed to make students' initial perceptions of the module seem easy to read and use and assist in gaining and maintaining students' attention and confidence (Keller, 1987; Keller & Burkman, 1993; Keller & Kopp, 1987; Keller & Suzuki, 1988).

A colleague who teaches educational technology courses evaluated the usability of the course and the immersive technology module before the course went live. Minor changes such as changing the typeface and font size, revising pages with lengthy text, and adding new pictures and video tutorials were applied to the module based on the recommendations.

During Week One, participants studied augmented reality and created an augmented reality project using the Arasma app. Augmented reality provides a live direct or indirect view of a physical, real-world environment whose elements are *augmented* (or supplemented or enhanced) by computer-generated sensory input such as sound, video, graphics, or GPS data. During Week Two, participants read about virtual reality in education, studied the SAMR model (Puentedura, 2015) of technology integration, and explored virtual reality apps using the free EON experience app. Participants then searched YouTube and the internet for three free virtual reality apps they would like to use in three different lesson plans.

To reduce the anxiety of finding

appropriate apps for the lesson plans, participants considered a list of free apps provided by the professor. Participants downloaded three different virtual reality apps to their smartphones or mobile devices, and created three different lesson plans that utilized each app to transform learning *above the line* according to Puentedura's (2015) model of technology integration, commonly referred to as the SAMR model. The SAMR model has two main components: enhancement and transformation. In the enhancement component, technology is used as a *Substitution* or for *Augmentation*. Above the line refers to the top tier of the model, the transformation component, where technology is used for *Modification* or *Redefinition*. The implication is that technology will most powerfully affect student achievement if it is used in the transformation component (Johnson, 2013/2014).

During Week Three, participants utilized Twitter and Pinterest as professional learning networks. They tweeted their thoughts of using immersive technology and shared how immersive technology can be used in the classroom. Then, participants searched for two individuals on Twitter who were tweeting about immersive technology (either augmented, virtual, or 3-D reality), and interacted with their tweets. Participants posted their responses to the following two items in Canvas, (1) what did you find on Twitter (provide a descriptive summary of the tweets), and (2) write a summary of your responses to the individuals you followed on Twitter. After reading about Pinterest and how educators use Pinterest in the classroom, participants ended the week by creating a Pinterest board. Participants' boards contained 12–15 pins on immersive technology. The links to their boards were posted in Canvas.

During Week Four, the final week of the module, participants viewed videos and examples on why and how to create 3-D lesson plans using EON Creator, an online 3-D creation tool. Participants' 3-D lessons were created using EON Creator, and had to include the following: one 3-D object (content topic), at least five annotations, one quiz with five questions relevant to the content, one YouTube video related to the object, one link to Wikipedia related to the object, one link to an internet website with more information on the object, one PowerPoint presentation with 3–4 slides that outline the main features of the object, and one audio file that describes a feature of the object.

While some participants owned their own headset, others borrowed a headset from the campus library. Participants received a lesson plan template with definitions and examples to guide them with their lessons' assignments.

Selected examples of participants' augmented reality projects using the Arasma app from Week One of the module included: homework lessons; book reviews; yearbooks; word walls; icebreakers; math reviews; and deaf and hard of hearing sign language flashcards. Participants' virtual reality lesson plans from Week Two of the module included apps to teach the following topics: the solar system; the monarch butterfly lifecycle; ancient Egyptian history; the extraction of gold from the earth; the extinction of rhinos; autobiographical and city tours of cities; displaced individuals from the Syrian refugee crisis; the history of Cuban dance; natural disasters; U.S. capitols; and articulation of words. Selected topics from participants' 3-D lesson plans from Week Four of the module included: the human heart, mouth, brain, and teeth; the statue of liberty; space shuttles; the skeleton system; the neuron cell; and ancient Egyptian leaders.

### *Data Collection and Data Analysis*

This study utilized the Instructional Materials Motivation Survey (IMMS) (Keller, 2010) as the data source to answer the research question. The IMMS was selected because the survey contained critical motivational factors from the ARCS model. The IMMS was not used to examine preservice teachers' academic performance or motivational reactions compared to a control group after receiving enhanced strategies and instruction on immersive technology. This study simply reports preservice teachers' reactions to creating and interfacing with immersive technology and does not quantify technology outcomes produced by students.

The IMMS contains 36 items. All survey items included Likert-style response scales with a score of one being *Not True* and a score of five being *Very True*. An additional item was added to the end of the survey. It read, *After completing this module, I am excited to use the material (augmented reality, virtual reality, 3-D) learned in this module in my own classroom.*

The survey contained four components based on the ARCS model: (1) Attention, (2) Relevance, (3) Confidence, and (4) Satisfaction. The Attention component had 12 items, and the Relevance and the Confidence components both had nine items. The Satisfaction component had six items. Keller (2010) validated the survey with undergraduate preservice teachers enrolled in an applied educational psychology course. Selected example survey items included:

- These materials are eye-catching. (Attention)
- It is clear to me how the content of this material is related to things I already know. (Relevance)
- As I worked on this module, I was confident that I could learn the content. (Confidence)
- Completing the assignments in this module gave me a satisfying feeling of accomplishment. (Satisfaction)

Hu's (2008) study of motivation and usability in a self-paced online learning environment provided additional internal consistency and validity of the IMMS. The internal consistency estimate for the entire scale used in this study, based on Cronbach's α, was .87 (see Table 1). An acceptable α value should be above .70 (DeVellis, 2003).

SPSS Statistics was used to calculate descriptive statistics. Negative items in the survey were reversed before they were added to the response totals.

Table 1. IMMSS reliability estimates from this study.

| Scale | Reliability estimate (Cronbach α) |
|---|---|
| Attention | .94 |
| Relevance | .87 |
| Confidence | .90 |
| Satisfaction | .93 |
| **Total scale** | .87 |

According to Keller (2010), there is no expectation of a normal distribution of responses because the survey is a situation-specific measure. Keller (2010) reminds others that one cannot designate a given score from the IMMS as high or low because there are no norms for the survey.

## Findings

All 27 participants completed the IMMS online. The research question asked *what are the motivational reactions from undergraduate preservice teachers to enhanced, online immersive technology instructional materials*? A summary of the survey findings is provided below. Table 2 provides an overview of descriptive statistics from the survey.

After looking at the module, the majority of the participants either responded not true (*N* = 12, 44%) or slightly true (*N* = 28, 30%) to the survey item when I first looked at this module, I had the impression that it would be easy for me. Participants thought there was something interesting at the beginning of the module that got their attention (very true, N = 6, 22%; mostly true, N = 5, 19%; and moderately true, N = 7, 26%). Nearly all participants (*N* = 26) agreed the materials in the module were eye-catching (very true, *N* = 6, 22%; mostly true, *N* = 9, 33%, moderately true, *N* = 7, 26%, and slightly true, *N* = 4, 15%), helped keep their attention (very true, *N* = 5, 19%; mostly true, *N* = 6, 22%; and moderately true, *N* = 8, 30%), and agreed the module was not abstract (*N* = 17, 63%).

Participants thought the module contained content that was worth knowing (very true, N = 6, 22%; mostly true, N = 8, 30%; moderately true, N = 7, 26%; slightly true, N = 4, 15%, and not true, N = 2, 7%), and was relevant to their needs (N = 22, 81%) and interests (very true, N = 2, 7%; mostly true, N = 5, 19%; and moderately true, N = 9, 33%).

The majority of participants stated the module content related to things they already knew (very true, 1, 4%; mostly true, 6, 22%, and moderately true, N = 10, 37%), and agreed repetition in the module did not cause boredom (N = 16, 59%). Further, nearly all participants (*N* = 25) agreed that completing the module successfully was important to them (very true, *N* = 12, 44%, mostly true, *N* = 5, 19%, moderately true, *N* = 6, 22%, and slightly true, *N* = 2, 7%).

After reading the introductory information, participants felt confident that they knew what they were supposed to do (very true, *N* = 3, 11%; mostly true, *N* = 9, 33%; and moderately true, *N* = 8, 30%), and agreed that the organization of the module helped build their confidence in learning the materials (*N* = 14, 52%). As participants worked on the module, the majority of participants were confident they could learn the content (very true, *N* = 7, 26%; mostly true, *N* = 7, 26%, and moderately true, *N* = 8, 30%), and after working on the module for awhile, participants felt confident they would be able to complete the assignments (very true, *N* = 7, 26%; mostly true, *N* = 7, 26%, and moderately true, *N* = 6, 22%).

The majority of participants responded favorably to the survey item that asked "completing the assignments in this module gave me a satisfying feeling of accomplishment" (Very true, *N* = 4, 15%; mostly true, *N* = 10, 37%, and moderately true (*N* = 7, 26%). Nearly all participants responded very true (*N* = 12, 48%) or mostly true (*N* = 6, 22%) to the survey item 'it felt good to successfully complete this module.' An equal number of participants (*N* = 17) reported that the module stimulated their curiosity (very true, *N* = 5, 19%; mostly true, *N* = 7, 26%, and moderately true, *N* = 5, 19%), and that they enjoyed studying the module (very true, *N* = 5, 19%; mostly true, *N* = 7, 26%, and moderately true, *N* = 5, 19%).

Participants enjoyed the module "so much" that they wanted to learn more about the topic (very true, *N* = 7, 26%, mostly true, *N* = 5, 19%, and moderately true *N* = 4, 15%), and shared that they learned things that were surprising and unexpected (very true, *N* = 22%; mostly true, *N* = 10, 37%; moderately true, *N* = 6, 22%; slightly true, *N* = 3, 11%, and not true, *N* = 2, 7%). The majority of participants agreed that after completing the module, they were excited to use immersive technology in their own classroom (very true, N = 5, 19%; mostly true, N = 5, 19%; moderately true, N = 9, 33%; slightly true, N = 3, 11%; and not true, N = 5, 19%).

## Discussion

This study collected data on preservice teachers' motivational reactions to an online course module on immersive technology designed using the ARCS model. The results of this study shed light on new opportunities for teacher educators to become familiar with immersive technologies, and suggest that such immersive technology tools and instructional design strategies should be integrated into teacher preparation curricula. As seen in this study and supported by re-

Table 2. Descriptive statistics from the IMMS survey.

| **Components** | ***M*** | ***SD*** |
|---|---|---|
| Attention | 3.65 | 1.24 |
| Relevance | 3.45 | 1.07 |
| Confidence | 3.28 | 1.21 |
| Satisfaction | 3.29 | 1.36 |
| **Additional Survey Question:** Excitement for future use in classroom | 3.07 | 1.33 |

*N* = 27

search, incorporating the ARCS model into the instructional design of a course enhances the motivational impact of instructional materials and activities (Proske, Roscoe, & McNamara, 2014).

The ARCS component Attention received a mean score of 3.65 (SD = 1.24). Participants, overall, believed that the strategies used in the module aroused and sustained their curiosity and interest in immersive technology. There may have been a novelty effect for participants when asked to leverage immersive technology within their teacher preparation experience. As discussed, the use of contemporary immersive technologies within teacher education is limited and hence, for many students, being assigned to put on a virtual reality headset and enter an immersive environment could have been stimulating primarily because it was new.

Keller (1987) argues that a motivational challenge with students is sustaining their attention and an important component of attention is variability. "No matter how interesting a given topic is, people will adapt to it and lose interest over time" (Keller & Suzuki, 2004, p. 231). The variability in the immersive technology module sustained participants' attention throughout the module. Participants became active participants in the learning process through the design of the module and hands-on practice with immersive technologies and lesson planning. Participants utilized different approaches to learn and apply immersive technology including the use of Twitter and Pinterest, which grabbed their attention until the module ended. When leveraged effectively, communication mechanisms such as Twitter and blogs can support increased engagement and motivation, group action, individual transformation, and shared meaning-making opportunities (Dawley & Dede, 2014).

Further research is needed with preservice teachers to see if this protocol continues to motivate them in their teaching practice after they complete their preparation programs. It would be interesting to see if immersive technology made preservice teachers contemplate their need as educators to keep abreast of technological developments, and whether this excited or depressed them. The need for preservice teachers to keep abreast of technological developments was not measured in this study.

The fact that the component Relevance did not see a dramatic drop-off from the Attention component (*M* = 3.45, SD = 1.07) in participants' responses suggests that participants recognized the importance of the technology and its relevancy to their future practice. The strategies used in the module were linked to participants' needs and interests. The module allowed participants to act on their thoughts, ideas, and experiences for self-directed learning (Cobb, 2007), and allowed them to embrace a new personalized and individualized learning platform (Dieker et al., 2014). Participants were able to choose their own apps, social media followers, design of their Pinterest boards, and lesson plan topics for this study. This allowed participants to create lessons and complete assignments that were aligned with their own goals and motives.

The relevance of the module allowed participants to make connections from the content of instruction to participants' future responsibilities as teachers (e.g. lesson planning and integration of technology in the classroom). Survey data suggest that participants believed the immersive technology module helped build their pedagogical knowledge in such a way that they would be better equipped to serve their future students. This was also supported by lesson plans submitted for assessment and course evaluation comments from participants. One participant commented on immersive technology and stated:

> [The instructor] was very effective in opening up my eyes to new tools that could be used in the teaching field. Some of them were geared at teaching, while some of them were not, and it was the ones that were not specifically teaching-related that opened up my eyes to the fact that a variety of technological tools [virtual reality] can be used in the classroom if one has the imagination to implement it.

The majority of comments from participants in the course evaluation echoed the same level of excitement to someday implement immersive technology in the classroom. Further research should incorporate qualitative data to confirm if preservice teachers see immersive technology as a relevant and important element of their emerging pedagogical skills.

It should be noted that most participants struggled to develop lesson plans "above the line" according to the SAMR model (Puentedura, 2015). This was not a surprise since most participants studied the model for the first time in the course and had few opportunities to see and read about teaching that modifies or redefines the curriculum using technology. This may have affected participants' confidence to work with immersive technology.

Overall, participants felt somewhat confident (*M* = 3.28, SD = 1.21) in their abilities to complete the module. Heafner (2004) reminds us that students' use and familiarity with technology makes technology more interesting for students. Participants studied immersive technology during Week Seven, midway through the 15-week semester. They used technology skills from previous modules in the course to approach and complete the immersive technology module. When challenging and engaging academic tasks build upon students' prior background knowledge and enable students to construct their own understanding of the content, they are more apt to enhance motivation and increase self-confidence in their cognitive abilities (Heafner, 2004).

Given the amount of technology participants studied prior to the immersive technology module, the score for the Confidence component was unexpected (*M* = 3.28, SD = 1.21). Participants, overall, believed that the strategies used in the module helped them develop a positive expectation for successful achievement with content from the module. However, the EON Creator server was offline for half of the semester and caused anxiety and frustration among participants. This may have contributed to participants' lower confidence scores. Some participants posted their 3-D lessons online before the EON Creator became unavailable; however, several participants were not able to post their lessons online because the EON Creator server was down.

Even though participants relied on their peers, the internet, and the instructor for technical assistance, a few participants shared in email and informal discussions during office hours that studying online rather than on campus increased their unease with the immersive technology tools. It is unknown if the failure of the EON Creator server and the inability to post participants' 3-D lesson online contributed to the unease.

In the end, participants took responsibility for their own performance; were persistent; developed creative, content specific projects; and were excited about sharing them with each other and others outside of the course. In fact, three students who completed the same technology course during different semesters presented their use of immersive technology at the annual undergraduate research and creative works conference sponsored by the institution of the researcher of this study, and won first place for best panel presentation. With improved output, students took pride in the products they created. When this happens, students' self-efficacy can increase and improved outputs can positively affect student motivation (Heafner, 2004).

Further research should explore if the lower confidence score meant that the preservice teachers lost confidence because of their engagement with technology. Would they have been equally confident, or more confident, had they not had to develop lesson plans with these newer tools?

The Satisfaction component (*M* = 3.29, SD = 1.36) demonstrated that generally participants were pleased with the module in advancing their developing practice, and felt the amount of work was appropriate. Participants believed that the strategies and assignments used in the module provided positive reinforcement for their effort in completing the module. People like the feeling of achievement that results from successfully completing a meaningful learning activity (Keller, 1987). Enjoyment through the use of technology significantly influences positive attitudes and reinforces intentions to use technology (Davis, 1989). When preservice teachers have positive experiences after undergoing challenging tasks in teaching, there is a greater chance of an increase in their positive outlook in future teaching situations (Wood, Mueller, Willoughby, Specht, & Deyoung, 2005).

As noted earlier, participants were excited to use immersive technology in their future classrooms. One participant wrote in the course evaluation, "[the module] challenged me to use many different kinds of technology and relate them to real life scenarios. I look forward to applying a lot of what I learned to my own classroom." Participants' overall satisfaction with the module suggests that the design of the module and participants' familiarity with immersive technology contributed to their belief in their ability to accomplish challenging tasks. The immersive technology module captured preservice teachers' attention and interest in immersive technology, and solidified the decision to include and expand the module in future course offerings.

## Implications for Teacher Education

In teacher education, the possibility of creating and interacting in environments in which preservice teachers experiment with a variety of decisions and outcomes without placing any real students at risk should be an exciting prospect for teacher educators (Brown, 1999). Brown argues that although simulated classrooms offer an alternative to teacher training, they should not replace field experiences and other traditional methods of teacher training any more than sophisticated flight simulators can replace actual time flying an aircraft.

As enrollment in online education and blended learning environments increases, immersive technologies will play an important role in students' learning experiences (Dawley & Dede, 2014). The implications for teacher educators with online and blended education are profound. These implications should include ongoing professional development for teacher educators in pedagogical and technical skills and ongoing professional development for instructional designers who work with teacher educators to develop online courses that utilize immersive technology.

Another implication for teacher educators and schools and colleges of education is to allow preservice teachers to use their mobile devices in brick and mortar classrooms to leverage the delivery of instruction. Incorporating an instructional model that utilizes devices students already own and use outside the classroom not only reduces the amount of hardware and networking investment required from education budgets, but also flattens the learning curve for students (Dunleavy et al., 2009).

Administrators such as deans, associate deans, and department chairs should purchase virtual reality headsets and keep them in the library or teaching and learning center for faculty members to explore at their leisure. Having virtual reality headsets on site eliminates the requirement for faculty and students to purchase their own headset. Administrators could reserve time during faculty meetings for technology training sessions where faculty members work in groups to learn immersive technology and discuss the ARCS model and ways immersive technology can support academic content that leads to effective instructional design.

Administrators could also conduct one or more faculty meetings virtually using immersive technology. This would allow faculty time to play with the technology with the intention of increasing their efficacy and motivation to use the technology, and would provide a safe environment for faculty to adjust to the technology before using it in their classrooms with students. At the K-12 level, administrators can use immersive technology for induction training of new teachers (Dieker et al., 2014). Teacher educators familiar with immersive technology can help facilitate these training sessions.

The survey score from the final survey item that gauged preservice teachers' excitement to use immersive technologies when they teach ($M$ = 3.07, SD = 1.33) makes it interesting for future researchers to delve deeper into understanding the students' engagement or frustration with these technologies. Preservice teachers who study immersive technology should apply it during methods courses, student teaching, and/or when in the classroom as a substitute teacher or completing practicum hours. Teacher educators should observe preservice teachers using immersive technology in the classroom and assist with the development of lesson plans and units that connect immersive technology to the curriculum.

As discussed earlier, the IMMS was not used to examine preservice teachers' academic performance and motivational reactions compared to a control group. Research is needed to understand motivation and performance gains using the ARCS model with groups of preservice teachers who use immersive technology with and without enhanced strategies and enhanced instruction.

## Limitations

There were a few limitations to this study. The sample size was small ($N$ = 27) and included one single course offered one time through one institution; therefore, the findings should not be generalized. This study relied on self-reported survey data from participants. An overarching issue with self-reports is credibility. Even when respondents do their best to be forthright and insightful, their self-reports are subject to inaccuracy (Paulhus & Vazire, 2009).

According to Song and Keller (2001), "the use of self-report methods for measuring motivation [is] limited in that such methods [require] students to indicate their perceived motivation level, which might have been different from their actual amount of effort-a more accurate measure of motivational behavior" (p. 20). Participants may not be able to provide the level of detail, or use the concepts that the researcher is interested in collecting (Barker, Pistrang, & Elliot, 2002).

An additional limitation was the use of one outside expert to evaluate the usability of the module. Nielsen and Mack (1994) recommend using the mean of a set of severity ratings from three evaluators for usability inspection purposes. This study was also limited in the number of weeks for data collection. The topic of immersive technology was covered in a 4-week module. Longer modules, perhaps even an entire course, on immersive technology and educational technology theory would have increased participants' interaction with and utilization of the technology.

Lastly, this study was confined to a solitary group operating with one particular teaching modality (online) and a single instructor. Further research should be conducted to validate this experience, not only with other groups who are learning primarily online, but also with those who are learning on ground and in blended/hybrid environments.

## Conclusion

Immersive technologies have had a long path to the classroom. For some, there may be too many constraints or risks associated with using these tools in the classroom (Graziano & Daley, 2017). As commercial opportunities continue to grow, so will engagement for educational purposes (Dawley & Dede, 2014). As seen in this study, preservice teachers are not only able to integrate these technologies into their starting pedagogical toolkit, but they are also impacted motivationally to use immersive technology with their own future instructional design. The opportunity, therefore, in further research and practice is quite profound. Leveraging these tools, particularly as they come down in costs, could be a boon for teacher educators and instructors of educational technology and their charges to foster real changes in education, particularly in the development of progressive pedagogies and learning strategies and the arrangement and delivery of content (Graziano & Daley, 2017).

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# 3 Questions for an Online Learning Leader

Featuring Russell Poulin, Director, Policy & Analysis, WCET—The Western Interstate Commission for Higher Education (WICHE) Cooperative for Educational Technologies

*Russ Poulin is a director of policy and analysis for WCET, the WICHE Cooperative for Educational Technologies, which is a national organization focused on the practice, policy, and advocacy of technology-enhanced learning in higher education. Russ directs WCET's state and national policy efforts, research activities, and multi-institution consortial partnerships to improve practices. In 2014, Russ represented the distance education community on the Department of Education's negotiated rulemaking team that considered the Department's proposed state authorization regulations.*

**1 Many who teach online may not be aware of or familiar with regulations from different oversight agencies regarding the state authorization of distance education courses and programs. What information should those involved with online learning be aware of in this era?**

Let's start with a basic piece of civics, the oversight of education is the purview of the states. They have the right to say who can or cannot offer higher education within a state's borders. Typically, that activity focused on institutions that were physically present within a state, such as those owning a building or renting a space on Main Street. For many years, states have had rules about which institutions are under their scrutiny and under what conditions those institutions can conduct activities in a state.

In 2010, the U.S. Department of Education decided to tie eligibility for federal financial aid to an institution having the proper authorization to serve students in a state. This surprised many of our colleagues at public and nonprofit institutions. Almost none of them had sought the proper authorizations and the task was daunting. Oddly, most of the for-profits were complying with these regulations. It also was a surprise to the state regulators that so many institutions were operating in their jurisdictions without proper approval.

Flash forward to 2017 and there is a new reality:

- On most campuses, someone is finally aware that they are supposed to be authorized where they serve students. Whether they've complied or not is another matter.

- The Department of Education had to reissue its regulation in 2016 and it is set to be enforced on July 1, 2018. However, Congress may


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kill that regulation in the next few months.

- Regardless of whether the Department of Education regulation survives or not, the states still expect institutions to follow their laws. Additionally, the 2,700+ institutions offering Tuition Assistance (a form of financial aid) for active duty military students are required to have the proper approvals.

- The State Authorization Reciprocity Agreement (SARA) has made life easier for almost 1,500 campuses and has extended protection to countless students who did not have it before. SARA uses standard criteria to allow an institution to be approved in its home state and for that action to be recognized in all participating states. As of this writing, that includes 47 states and the District of Columbia. California, Florida, and Massachusetts are in a race to be last to join.

There are lots of myths around state authorization including that it is a money-making scheme for states. Very few states recovered the costs of the efforts. The actual focus is on providing consumer protections to students who otherwise would be left to resolving problems on their own. Institutions of all kinds have treated student poorly, whether at a distance or face-to-face. Providing students with some protections is well worth the inconvenience institutions face in being authorized.

**2 What are some of the most significant issues in e-learning today and what kinds of solutions are being explored?**

We are witnessing the withering away of several time-tested and familiar constructs for higher education and technology-mediated education is contributing to that erosion process.

Just in Time Learning—The traditional college education will remain for a long time, as there will be a subset of young people who will want to have that more leisurely experience of a campus learning and social environment. Everyone else will still want education or training, but they will want it now. Traditional age students looking for work and adults upgrading their skills will be much more focused on the amount of time it will take to learn. They have a need and they need to fulfill that need now. Khan Academy and StraighterLine are more academic examples of organizations using the web to get people the skills they need on their own timeline. Coding bootcamps do not ask you to wait until next August (when the next academic year begins) to start your new life. Higher education will be under increasing pressure to respond and educational technologies will be key as the solution will require a mix of prepared videos, lessons, and simulations, along with human intervention.

Alternative credentials—The associate's, bachelor's, master's, and doctorate categories simply do not work for a growing portion of learners. They need to obtain a smaller package of knowledge and skills, and they need to certified as having reached mastery level. Grades actually (such as a C in a course) often codify that the student HAS NOT reached mastery and are silent on which skills are missing. Is the student missing something fundamental that will keep him or her for succeeding at the next level or did the student master the work, but was downgraded for turning in an assignment late? Each of the armed services just mapped all of their active-duty jobs to credentials for civilians. The criteria ignored accreditation and worried only about industry-accepted credentials. Meaningful, smaller scale credentials will be demanded by the workforce. Again, educational technologies can be part of that solution.

Alternative providers—There is a growing number of nonaccredited (and often nonregulated) providers of postsecondary education and training. Higher education ignores them at their own risk. States will also have to pay attention to them, because these entities can no longer continue offering high-value credentials at a significant cost without assuring that student consumers are protected. Many of these providers use education technologies. How can higher education learn from them, improve on their practices, and/or partner with them?

## 3 Which digital tools do you think are most underutilized in education?

The world is moving from desktops and laptops to mobile devices. Higher education is making the switch, but they need to follow their students and make the switch. This also opens up new opportunities for learning. How can such tools as Google Maps, augmented reality, and virtual reality change the learning landscape when you are on a mobile platform? Education is no longer watching videos and reading text in your bedroom. There are new opportunities to be become interactive with and to capture your environment. History courses come alive with augmented reality tours of historic downtown. Anatomy courses come alive if I can travel down the aorta to see examples of various obstructions. The mobile world gives us both the freedom and the overwhelming responsibility to make learning mobile…and active. In his book, *Brain Rules*, John Medina talks about the importance of exercise and sensory integration into the learning process. Let’s get moving.

# A Review of *What Connected Educators Do Differently*

Whitaker, T., Zoul, J., & Casas, J. (2015). *What connected educators do differently*. New York: Routledge.

By Tisha Duncan, Ed.D., *Meredith College*

Abstract

*Connections to others are important in any field or educational context. Connecting to colleagues and students is especially critical in digital learning environments. What Connected Educators Do Differently is a recommended read for anyone who teaches—especially those in virtual or hybrid classrooms. The notions of connecting personally and professionally through communication, collaboration, and community are at the core of this book.*

***Keywords:*** *personal and professional networks (P2LNs), digital learning environment, communication, collaboration, community*

## Introduction

While searching for current readings on working with postsecondary students in a digital learning environment, this text was selected based on the idea that connected educators are unique or set apart in some way from one another's counterparts. The premise of this book is making connections and highlighting the numerous ways which connected educators of any grade level, from pre-K to higher education, meet their own professional needs, as well as, the needs of their students with and through personal and professional learning networks. The book encourages readers to reflect and self-assess his/her current practice to determine areas of strength and goals for improvement. Anyone serving in a role in the field of education, from a child care provider to a higher education administrator, would benefit from the stories and ideas throughout the text on how to increase professional and personal connections.

## Background

The authors who collaborated to write this text are educators and actively working in the field of education either in leadership and/or supervisor roles. Collectively, they have many years of experience as elementary, middle, and secondary public school


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teachers and researchers using both traditional and digital platforms. Additionally, all three authors have served as high school principals; while one is now a professor and a second is a K-12 school superintendent.

Whitaker et al. share that this book is a result of their own networking and the successful product of their initial chance meeting, which developed into a strong working relationship. The purpose of the book is to highlight stories, people, and resources from their own personal and professional networks ($P^2$LNs) in order to encourage others in the field to become more connected to their work. There are frequent stories and references to people they have met through their connections who serve at a variety of educational levels. They have coined the $P^2$LN phrase to represent "P to the power of 2" (p. xxiv), placing emphasis on the importance of developing both components of networking.

## Text Design and Layout

Whitaker, Zoul, and Casas developed the book around eight *key connectors* to encourage the reader to find ways to maximize one's personal and professional life by becoming more connected: (1) Invest in a Personal and Professional Learning Network ($P^2$LN); (2) Learn What They Want, When They Want, How They Want; (3) Embrace the Three Cs: Communication, Collaboration, and Community; (4) Give and Take ... and Give Some More; (5) Strive to Be Tomorrow ... Today; (6) Know That It Is Still About the 3 Rs: Relationships, Relationships, Relationships; (7) Model the Way; and (8) Know When to Unplug. The authors emphasize the importance of being connected in the profession as a mindset more so than one specific idea, program, or component. The book is comprised of an opening introduction followed by eight chapters, which correspond with the key connectors. These key connectors are single action steps for educators to follow to be intentional in their learning and growth.

Every chapter defines and provides examples of a key connector and concludes with three short sections titled, *Follow 5*, *Find 5*, *Take 5*. *Follow 5* provides a list of advice from five educators the authors of the text feel embody the components of the chapter. *Find 5* is a list of online resources and/or tools for the reader to further develop one's own skills. *Take 5* offers suggested action steps the reader can take to either get started or continue to develop as a connected educator. The latter seems to be the most valuable component of the text. Each of these three sections builds upon the next throughout the book, thereby reinforcing ideas and knowledge gained.

## Chapters 1 and 2

Chapters 1 and 2 focus on the foundational terminology to be used throughout the book and introduce the reader to the ($P^2$LN) model of investing in a Personal and Professional Learning Network, as well as, the social media platform, Twitter. The authors write in such a way that it is easy for the reader to be able to relate to their stories and positions. Additionally, the description of Twitter provides the reader with the ability to immediately open and start an account.

## Chapter 3

Chapter 3 highlights the three C's: Communication, Collaboration, and Community. The authors emphasize the importance of combining these three areas with purpose, passion, and pride. This translates into a chapter which motivates the reader to reflect on his/her current practices and how they may be improved. As the field of education is continually critiqued and examined, the following provides a point of inspiration and self-reflection for the reader:

> The challenge facing schools today is the ability to cultivate a culture wherein all members of the school community feel comfortable in disrupting routines long established by the status quo and embrace a connected world which world is ready to support their desire to learn without limits. (p. 30)

## Chapters 4 and 5

Chapters 4 and 5 continue the motivational trend and encourage connected educators to find ways to give back, not only take, to other people within their network. There are three types of people described: the givers, takers, and matchers. As with other forms of educational networking texts, sharing and stealing of ideas is encouraged rather than borrowing. The authors contend that *borrowing* can often be a transaction limited to material things, such as paper, pencils, worksheets, books, etc., as opposed to ideas about how to improve a topic, lesson, or engagement with students. In short, "the original item tended to stay with the original owner, even if the borrower used it, too" (p. 53). The idea of borrowing means that it will not be changed, but stealing it and making it one's own allows for enhancing the original idea, thereby taking ownership to share with another. Through shifting the thinking to *stealing* an idea, "we honor this person by not taking what she has to share and using it exactly as designed, but by taking it, using it, strengthening it, and sharing it anew with others," thereby owning it ourselves before giving it back again (p. 53). The authors challenge one's thinking about taking and giving within the frame of a network.

## Chapter 6

Chapter 6 parallels the phrase used in real estate, *location*, *location*, *location*, with encouraging readers to remember their PLN growth starts with trust in building *relationships*, *relationships*, *relationships.* The authors remind the reader that this book is the outcome of them meeting and developing their relationship over time with one another. The focus is not solely on relationships with students and co-workers in their direct environment, but also, through colleagues found around the world. Again, the use of Twitter to aid in this group of followers and networking web is reiterated throughout.

## Chapter 7

Chapter 7 shifts toward the importance of modeling for others in response to a need as well as to inspire and integrate opportunities for collaboration. The authors are both practical and realistic in their advice to readers. The tone of the writing is positive and addresses the facets of failure which can occur in any position. The choices made after the failure are the focus of how to change, as well as, encouraging risk-taking.

Perhaps, one of the most surprising chapters is the final chapter on knowing when to disconnect or unplug from technology. After the build up to working toward connections primarily through social media access and various other digital sources, the authors leave the reader with the reminder that the opportunity to limit screen time and social media engagement is equally important. They emphasize ways the connected educator reflects, reads, and takes moments of solitude to rejuvenate. This conclusion is both unexpected and refreshing.

## Conclusion

Initially, the book seems to be geared toward multiple ways to connect digitally to postsecondary students with tips and resources. However, the presentation of the book as a personal narrative is much more in line with how to develop relationships that lead to connections. The primary tool for connecting both professionally and personally with great emphasis throughout is the Twitter platform. For readers who may not want to start a Twitter account, they may find that this book will not directly apply to their needs. However, one can still find a good deal of information and ways to shift one's thinking toward how to further grow a personal and professional learning network. The material and insights gained are relevant for educators at all levels from primary to post-secondary in both traditional and online settings.

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# Thinking of Rubrics for your Online Course? Consider these Features

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Abstract

*Owing to their numerous benefits, rubrics should be included in all classrooms: especially those that are online. Knowing what features to evaluate can streamline the rubric selection process in order to choose the best rubric for program, School/College, university, or external reporting needs. Straightforward use, rapid build, simple collaboration, and uncomplicated reporting are recommended features to consider.*

***Keywords:*** *rubric, iRubric, assessment, data reporting*

## Introduction

The use of rubrics in higher education has taken shape over the last decade as more faculty members and institutions realize the benefits (Reddy & Andradae, 2010; Swarat et al., 2017). Benefits include consistency when scoring work, improving instruction by making assessment expectations explicit, and overall, supporting best practices. In a traditional brick and mortar teaching and learning environment, rubrics are distributed during class sessions and reviewed face-to-face. Professors can then hand back completed rubrics attached to each student's assignment submission. This process needs to be slightly altered for an online classroom environment. Online rubrics need to be easy for students and faculty members to use, help streamline the grading process, and provide an efficient way to collect data about how students meet course, program, and institutional objectives. This review highlights some of the key features to consider when selecting an online rubric tool or system.

## Straightforward Use

The most important element when selecting an online rubric tool is an easy to use system. Although faculties and students have different interactions with a rubric tool, it needs to be intuitive for both. Clarity, efficiency, and accessibility are a few considerations.

For a faculty member, the system needs to be clear-cut in regard to assessing student work, entering com-



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ments, and posting rubrics to the online classroom and gradebook. Providing a system that has clickable cells is vital because it can allow a faculty member to focus on the feedback and comments that should be provided to the student. A great benefit is being able to click individual cells that reflect the student's level of mastery in an efficient manner that saves both time and paper. Other advantages include having electronically archived records of students' strengths and weaknesses and having at-a-glance data about how students are doing in terms of line-by-line accreditation, program, or university standards. This is the type of system that helps create faculty buy-in.

Furthermore, both the blank and graded rubric versions should be easily accessible to students within the Learning Management System (LMS) assignment area or gradebook to help ensure that students will review them before, during, and after assignments are completed. When rubrics are more visible and accessible in an online course, the expectations are clearer and students have a greater likelihood of being successful. Students deserve to have the ability to see rubrics ahead of time and after submitting assignments in order to have explicit information about what they are to do and how they did it. Then, the grade or evaluation rating from the rubric should be easily passed to the LMS gradebook without requiring the faculty member to download a spreadsheet and manually input the data.

For students, the rubric tool should not be burdensome to read or understand. There should be few questions resulting from using the system. Being able to preview the criteria before beginning the assignment or project is also an important consideration for both students and faculty members. Even given the ability to print the previewed rubric is very helpful to students if they need to work on an assignment offline. Once the assignment has been assessed, a student should be able to easily view what the final evaluation is and quickly see the comments associated with each rubric aspect. Therefore, to accommodate this ease of use, rubric integration in the classroom is essential.

## Rapid Build

For faculty members to use the tool, there needs to be a system where rubrics can be built quickly. Traditionally, rubrics are in a grid or spreadsheet style; so, systems that employ these types are user friendly to students and faculties. The ability to use templates, import existing rubrics, and repurpose already created rubrics makes for an ideal system to use because these aspects save time. Providing faculty members access to rubrics built by colleagues or directors within the same program or school/college is a time-saving approach as well.

If the rubrics are to be built from scratch, the interface should be simple to navigate. Faculty members should be able to readily locate where to enter all the information for the rubric. The rubric title, mastery level (or column title), aspect title and description (or row), and all the details of each criterion used for evaluation need to be easy to locate, enter, and save. If needed, faculty members should also be able to vary the aspects and columns with the appropriate weights for a given assignment. Another important consideration is the alignment of the rubric to standards that might be needed or required for accreditation, state, or institutional reporting. Linked standards are beneficial when reports are derived from the rubrics.

## Simple Collaboration

The strength of using a rubric to evaluate assessments is the ability for multiple faculty members to evaluate a single piece of work by a student. Perhaps, the work is a capstone project or ePortfolio that demonstrates a student's mastery of key skills and abilities within or even across courses in a program. The best online rubric tools provide a way for faculty members to evaluate the student's work, review the ratings by other faculty members, and then share this overall assessment with the student. There is efficiency when various faculty members evaluate similar or different rubric aspects dependent on certain courses or even expertise. For example, one key course assessment might be used as evidence for multiple objectives evaluated by professors with different skill sets.

This type of system is also powerful when considering reliability between evaluators. The collaboration should also extend to the creation of the rubric. Providing a system that faculty members can share and work together on to create, monitor, and revise rubrics is a vital part of any online rubric system.

## Uncomplicated Reporting

The most practical online rubric systems have reporting that is uncomplicated. The reports should be easy to create, store, share, and manipulate. Colleges or Schools, universities, departments, programs, and individuals may have multiple needs for data presentation; so, a system that supports generating quick reports to pinpoint and highlight the data most important to that reporting is crucial. Systems should have practical features that allow for easy data presentation in charts, graphs, or even tables as well as aggregating and disaggregating data. As mentioned earlier, standards applicable to accreditation, state, or institution are very important and the ability to align them to rubrics is vital. Reporting on these standards is a necessity for any online rubric system.

## Conclusion

The adoption of an online rubric tool can provide a quick and potentially data-rich avenue in the online classroom space. LMS platforms such as Angel, Blackboard Learn, and D2L Brightspace have their own rubric tools built in; or, can adopt a system like iRubric from RCampus, which is integrated into the LMS. There are other tools available like ForAllRubrics, which have been designed for K12 spaces; and even Turnitin has rubric capabilities. Every system offers its own robust possibilities to meet the needs of different assessment situations and reporting requirements. Every institution should examine their needs to determine what online rubric system would best serve their requirements.

## Resources

http://www.angellearning.com/products/lms/rubrics.html

https://help.blackboard.com/Learn/Instructor/Grade/Rubrics

https://www.forallrubrics.com/

http://www.rcampus.com/

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