A Multimodal Approach to Online Assessment

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The evolution of new technology is rapidly transforming traditional methods of instruction, giving rise to a host of educational options, challenges, and resources. The incorporation of these technologies within the corporate workplace has also created a need for educational systems to address 21st-century technology skills (McCurry, 2003, p. 422), but how will instructors find time to address the individual needs of each learner? The overburdened educational system is already straining beneath the weight of existing standards, made more imperative by shrinking budgets and increasing workloads, yet "individualization, based on modern educational technology, is one of the models of the solution to the exit from the current crisis of the educational system" (Stanković, Maksimović, & Osmanović, 2018, p. 107). The ability to address these individual needs is becoming a sharp priority. One proposed solution to the individualization puzzle is the learning management system (LMS). These flexible delivery systems allow for whole group instruction but can also target individual learner needs. As the concept of distance learning continues to evolve, the usage of online LMS is becoming a standard delivery method of instruction (Akhter, 2015). This increased usage, as well as increasing course involvement on the part of both students and faculty, underscores the necessity for effective use of a learning management system (Claar, Portolese Dias, & Shields, 2014). Learning management systems often provide flexibility in the delivery of instruction (Bradford, Porciello, Balkon, & Backus, 2007). However, differentiating content matter to address the learning needs of all learners is still the responsibility of the instructional designer. While learner needs are addressed in the instructional design phase, online courses present a unique challenge, since the instructional designer will often have limited information about the potential learners (Dick, Carey, & Carey, 2005).

Statement of the Problem

As instructional materials are moving into the digital realm, new challenges are emerging. Traditional courses historically provided clearly defined and tightly enforced boundaries (Kress, Jewitt, & Tsatsarelis, 2000). Common methods of instruction and assessment included writing, speech, numerical means, and limited images (Kress & Selander, 2012). At the turn of the century, the communication of ideas using video, web design, and multimedia materials were somewhat sporadic, but beginning to emerge in the educational landscape (McCurry, 2003, p. 432). Technology began to create a conflict within the traditional learning norms, adding new ideas that require the transformation of the existing educational system (Stanković, Maksimović, & Osmanović, 2018, p. 108). The changing landscape of communication brought new modes other than language into play (Kress, Jewitt, & Tsatsarelis, 2000). These new, multimodal options erode the perceptions of traditional boundaries, placing more emphasis on visual representations and allowing the possibilities of "an aesthetic discourse into a domain where previously it had no place" (Kress, Jewitt, & Tsatsarelis, 2000). The concept of multimodal communication is beginning to influence the instructional community (Kress, Jewitt, & Tsatsarelis, 2000) and some researchers reveal that focusing on language alone is no longer enough (Lankshear & Knobel, 2011, p. 87).

Learning management systems are equipped to address multimodal delivery and assessment, as well as other forms of differentiation. Continuous feedback throughout the course is a necessary component of a successful online learning program (Akhter, 2015). Students also prefer choice within the online class—for example, when they are allowed to select learning modules from a menu of choices (Lindgren & McDaniel, 2012). The integration of multimedia options has permitted the evolution of new and varied methods of content delivery (Stanković,

Maksimović, & Osmanović, 2018, p. 113). While the value of multimedia content has been explored and documented, the subject of assessment differentiation in an online environment is still scarce (Haelermans, Ghysels, & Prince, 2015). The possibility to argue back — in a video, in writing, in speech, in multimodal ensembles has changed the potentials for the effects of what was always inner agency into outward manifestations (Kress & Selander, 2012).

One issue concerning multimodality within assessment options is that the definition of online differentiation appears to be ambiguous. Beasley and Beck (2017) attempted to define differentiation within an online setting and found that online instructors fell into two distinct schools of thought. Online teachers would either describe why a student needed differentiation, or what material needed to be differentiated; this differed significantly from traditional teachers (Beasley & Beck, 2017). They also pointed out that assessment data was "notably absent" to determine the need for differentiation, and that future research should consider how online teachers differentiate, as well as how they decide to adjust instruction (Beasley & Beck, 2017). There also appears to be a lack of research where differentiated online assessment has been documented and measured.

Purpose of the Study

As Beasley and Beck (2017) point out, online instructors do not always differentiate in the best interest of the student; this is a stark difference from traditional educators, who appear to have a deep understanding of when differentiation is necessary. The purpose of this study will be to identify the relationship between digital differentiation and content mastery; specifically, if assessment differentiation affects the outcome of content mastery when assessment choice is given to the learner based on their preferred learning style. A secondary element of the study also

seeks to determine if assessment choice adds to the satisfaction level of the learner and makes them feel more connected to their instructor.

Theoretical Framework

This study focuses on the concepts established in Multimodality theory (Kress, Jewitt, & Tsatsarelis, 2000), while the content delivery methods are based on the cognitive theory of multimedia learning (Greer, Crutchfield, & Woods, 2013). Kress, Jewitt, and Tsatsarelis (2000) assert that within online education, images play a central role in representation, moving from the function of 'illustration" to the role of full communication. The ability to respond in video, audio, writing or a combination thereof opens the potential for increased communication (Kress & Selander, 2012). Multimodality allows the choice of/from a range of modes as a means of knowledge construction; this freedom allows for greater use and development of each method (Kress, Jewitt, & Tsatsarelis, 2000). Multimodal representation corrodes traditional educational boundaries, where the focus on writing as a central reflection of knowledge is deemphasized while a greater representation of visual or auditory artifacts allows for the communication of content knowledge (Kress, Jewitt, & Tsatsarelis, 2000).

Mayer's Cognitive Theory of Multimedia Learning addresses the delivery of multimedia content without cognitive overload. Rather than a single method of input, both hearing and sight (Dual-Coding Theory) activate the sensory memory (Sweller & Chandler, 1991). Multimedia learning takes place within the working memory, which temporarily retains the memory and manages knowledge within the active consciousness before transferring the knowledge into the longterm (Sweller & Chandler, 1991). This theory posits that the brain does not interpret a multimedia presentation of words, pictures, and auditory information in a mutually exclusive

fashion; the elements are dynamically selected and organized to produce logical mental constructs (Mayer & Moreno, 2003).

Significance of the Study

While there are several studies available that determine online best practices, none of these studies address differentiation within an online setting (Akhter, 2015; Chawdhry, Paullet, & Benjamin, 2011, 2012; Ergul Sonmez & Koc, 2018; Lindgren & McDaniel, 2012; O'Neill, 2017; Sullivan, Neu, & Fengrong Yang, 2018; Truhlar, Walter, & Williams, 2018) . This study may be useful in developing differentiation methods for effective online course design, thereby giving instructors direction when considering the needs of all learning styles within the online learning management system. The study may also contribute to multimodality theory, adding weight to the concept of allowing multimodal assessments when a specific mode is not required.

Research Questions

Given the lack of research in the area of multimodal assessments within online platforms, we believe that further research is warranted. The primary focus will be the effectiveness of choice, and how the ability to choose affects the final learning outcome. We also wonder if the ability to choose the assessment will have an impact on the student satisfaction within an online course; this data could be useful for retention methods. Based on thoughts, the following research questions are proposed:

· How does digital assessment differentiation affect learning mastery among learner types within an online learning environment?

· How does digital assessment differentiation affect learner perception of the online learning environment?

Hypotheses

Based on the research questions outlined above, we present the following hypotheses:

1) We believe that digital assessment differentiation will produce a significant finding that the ability to choose will allow the learner a greater range of multimodal content expression, thereby demonstrating content mastery using the learning mode that allows them to communicate easily, as opposed to the traditional text-based assessment methods.

2) We believe that digital assessment differentiation will produce a significant effect on the learner satisfaction of online course delivery.

Definition of Terms

Differentiation

This method of teaching requires teachers to modify curriculum, instructional methods, learning materials and activities, and learning artifacts to reflect the individual learning styles of the learner to maximize opportunities for all students (Tomlinson et al., 2003).

Distance learning

When instruction is delivered in a different place than the learning occurs, which often requires communication technologies and specialized institutional organization (Moore & Kearsley, 2011).

Learning management system

An Internet-based application that provides controlled-access courses that deliver instructional tools, forums, and grade books (Richey, 2013).

Mastery

The concept that, when learning conditions, instruction, and time are adequately addressed, the student will demonstrate a high level of achievement (Richey, 2013).

Multimedia

The use of audio and visual methods such as photo and videos to present concepts, words, and illustrations (Richey, 2013).

Online Course

The delivery of an institution-based, formal education where the learner is separated, requiring an interactive telecommunication system to connect the learner with the instructors and resources (Simonson, Smaldino, & Zvacek, 2014).

Delimitations

Delimitations of this proposal include the learner environment, a literature review of learning management systems, and the sample set. An analysis of the learner environment will not be conducted due to the online nature of the course. The learner environment is designated merely "online," as resources are not available to observe every learner in their chosen environment at all times. A literature review concerning the effectiveness of learning management systems will not be conducted due to time constraints and to manage the scope and breadth of the research. Finally, the study will only reflect higher education as a K-12 research project would exhaust the resources currently available to experiment.

Limitations

We recognize several limitations concerning this proposed study. The initial assessment that determines the learner type is self-reported, and that this method of assessment is deemed controversial (Alian & Shaout, 2017). The VARK assessment details a list of guidelines to apply

the evaluation within a research environment; we will adhere to those guidelines to preserve the validity of the research. The learner must have access to the learning management system; if their access is disrupted, the learner may be excluded from the study. We also recognize that our sample may contain a wide range of ages and that the mixed generations of the online learners will yield a fluctuation in technology skills. Finally, we recognize that environmental effects may influence the online learner, and that they may choose to utilize an assessment mode that they would not use when they are not observed.

Assumptions

We assume that our subjects will answer the initial VARK questionnaire as honestly as possible. Given the course level of the participants, we believe that the students will have a measure of comfortability in the navigation of the learning management system. As the research is conducted as part of an online course, we assume that participants will perform at the academic level that they have demonstrated previously.

Research Design

An Internet-based field experiment was chosen for this research as we are studying the effectiveness of digital differentiation via an online course. Courses are delivered in an online atmosphere within a learning management system, giving the researcher control over several issues that may arise outside of an LMS such as the ability to prevent multiple submissions, as well as precise tracking of dropouts. Student learning styles will be determined via a VARK questionnaire, delivered through the learning management system. Students will then be sorted randomly into the control and experimental groups using Borg and Gall's (1979) guidelines for matched-pair design. Students will be placed in rank order within their highest intelligence style; the two highest-ranking students within each style will become a matched pair. This method was

chosen so that avoiding a loss of subjects provides a counterbalance to the loss of precision

(Cohen, Manion, & Morrison, 2018). Each individual within the matched pair will be randomly

assigned to the control or experimental group within the learning management system.

The content of the course will be delivered identically to both groups through the learning

management system via a combination of video lecture and online documents based on the

cognitive theory of multimedia learning. The experimental treatment is the digital differentiation

of the assessment. The experimental group will receive the opportunity to choose how to submit

the assessment, while the control group will utilize a standard assessment. Due to the high

number of variables, an analysis of variance (ANOVA) will be used to compare the control and

experimental groups and test the hypotheses.

Variables

The dependent variables are the demonstration of mastery and learner satisfaction. The

independent variable is the choice of assessment. The differentiated assessment is isolated within

the learning management system, providing a method to consistently and reliably collect and

export the data.. The experimental treatment is the distribution of the differentiated assessment to

the experimental group, allowing the experimental group to choose their assessment methods.

The measure of mastery is the same for both control groups; the only difference is the delivery

vehicle. The learning management system ensures that there is no contamination of the sample.

Independent variables that may or may not reveal statistical data are the age, gender,

economic status and ethnicity of the student. This data will be derived from student enrollment

data. The learning management system will provide the assessment subject, as well as the time

that the assessment was delivered. Learning styles will be measured and reported by the VARK

questionnaire.

Participants

A large sample size is required to offset the number of variables, as well as the subgroups that will be analyzed (Borg & Gall, 1979). Therefore, we will utilize probability-based cluster sampling to pull the sample set. The research will focus on four public universities within the Houston area and will include college students in different fields of study. The sample will focus on students at the sophomore level to ensure that there is prior knowledge of online course navigation. Students will not receive compensation for the study; the assessment will be delivered as part of the online course. Students who do not have a matched pair will be excluded from the data set, as will any student who does not complete the VARK questionnaire.

Instrumentation

Two modes of data collection will be utilized. The first mode is the delivery of the VARK questionnaire to determine the preferred learning style of the subject. This questionnaire allows the subject to self-identify their preferred method of learning. The survey will be delivered within the learning management system to maintain the validity of the responses; subjects who do not answer every question will be excluded from the final data set. The LMS allows for the export of this data.

The controlled assessment will be delivered within the LMS quiz module, using a multiple-choice format. In the control group, the instructor will create an assessment within the LMS using a multiple-choice quiz feature. The questions will be aligned to the measurement standards provided by the instructor, and assessment responses will be reported through the LMS data system. In the experimental group, the instructor will create the assessment utilizing the assignment feature, which allows multiple submission format options. The differentiated assessment will also be delivered within the LMS and allow the subject to choose their preferred

method of assessment. The experimental group will be allowed to respond to the assignment via text, an audio file, photographic evidence of learning, or by submitting a multimedia video. The standards will be aligned with a rubric that ensures the measure of content mastery.

Reliability

When following the guidelines set forth by Fleming and Mills (2019), the VARK questionnaire can be deemed reliable. Care must be taken to follow these guidelines, which include a designated research-based algorithm while analyzing results. However, individual results may change over time based on personal growth. The assessment methods within the learning management system are also deemed reliable due to the ability to replicate the assessment options as well as the measurements of the standards used to determine content mastery. The assessments also demonstrate equivalent forms of reliability, as each form of the test should deliver the same results. These assessments can be used again within future online courses to measure the same material consistently.

Internal Validity

Internal validity may be challenged upon data analysis due to the limitations of sampling within the regional area, as well as attrition if students drop the course before completion of the assessment. Care must also be taken to review instructor-based standards and the connection established within the LMS to ensure that the data export accurately reflects content mastery.

Data collector characteristics and bias are avoided due to the online grading system, however, instructor error is possible as they will be responsible for evaluating the rubric-based assessments.It is also possible that students may exhibit the Hawthorne Effect; to avoid this, the particular details of the study will remain undisclosed. Finally, conditions of the assessment

cannot be explicitly determined; online students can take the test from anywhere and therefore cannot be controlled.

External validity

A possible concern of external validity may be determined due to the convenience sampling of nearby college students. However, as the subject of the research reflects a portion of the population that is directly impacted by multimodality within an online course, this is noted.

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