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Editorial: Conceptual Dilution

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Any concept that is widely adopted by scholars and practitioners inevitably is used in ways that the originators did not intend. Expansion of a concept in this way can be described as *conceptual dilution*. Conceptual dilution does not refer to the necessary process of refining a theoretical model over time, often with empirical evidence. Rather, it refers to the unintended use of and expansion of a concept beyond its original definition or intent.

This article identifies examples of conceptual dilution in the field of educational technology. The editors of leading journals in the field contributed instances of conceptual dilution observed in submissions to their respective journals. In many instances, the editors of these journals maintain a database of responses to authors who submit articles containing instances of conceptual dilution. These examples are presented as an aid to prospective authors who are contemplating submission of articles in these topic areas.

Each year the presidents of 12 national teacher educator associations meet for a 2-day retreat at the National Technology Leadership Summit (NTLS). The annual leadership summit provides an opportunity for dialog across associations and disciplines. The editors of technology journals published by these associations also participate, disseminating results and outcomes through their respective journals when warranted. The discussion of conceptual dilution described here took place at NTLS 2018 (www.ntls.info). The following journals were represented:

- *Journal of Technology and Teacher Education*
  Richard Ferdig, Editor
- *Journal of Digital Learning in Teacher Education*
  Denise A. Schmidt-Crawford, Editor
- *Contemporary Issues in Technology and Teacher Education*
  Chrystalla Mouza, Editor, and Glen Bull, Founding Editor
- *Smart Learning Environments*
  Kinshuk, Editor
- *Tech Trends*
  Charles Hodges, Editor
- *Interdisciplinary Journal of Problem-based Learning*
  Michael Grant, Editor
- *Journal of Online Learning Research*
  Leanna Archambault and Jered Borup, Editors

The editor or editors of each journal identified an instance of conceptual dilution that recurred frequently in submissions to that journal. The editors also described feedback provided to authors in those instances. To facilitate dialog about this phenomenon and facilitate successful submission of articles by authors, we provide the following examples of conceptual dilution and editorial responses.

Educational Computing Languages

The occurrence of conceptual dilution in the field of educational computing can be traced to development of the first computing language at the dawn of educational technology. Seymour Papert developed the design specifications for Logo in the summer of 1966. Papert, influenced by his work with Piaget, was not merely developing a computing language. He designed Logo with the intention of using it as a tool to facilitate children's thinking and problem solving. Publication of Papert's book, *Mindstorms: Children, Computers and Powerful Ideas*, in 1980 led to widespread recognition and use of Logo.

The Logo team was initially exhilarated when educators subsequently gathered at M.I.T. for the first National Logo Conference in 1984. Their exhilaration was tempered as it became evident that many Logo enthusiasts were using the language in ways that Papert never envisioned or intended. Papert later ruefully reflected about his creation:

We were sure that when computers became as common as pencils (which we knew would happen) education would change as fast and as deeply as the transformations through which we were living in civil rights and social and sexual relations. … Some of my colleagues are disappointed that School manages to so dilute the ideas or so circumscribe their impact that they can be 'integrated' into an essentially unchanged system. (Papert, 2005, p. 8)

A focus on workforce development during that era led some educators to use it primarily as a tool for teaching coding and computer programming. It was often done in a rote way by teachers who did not fully understand the nuances of the language. Many of the students who participated in these activities subsequently reported that they grew to dislike coding as a result.

TPACK

The Technology, Pedagogy, and Content Knowledge (TPACK) conceptual framework is one of the most influential in the field of educational technology (e.g., Angeli & Valanides, 2009; Ferdig, 2006; Mishra & Koehler, 2006; Niess, 2005; Pierson, 2001). It has been cited thousands of times and has been the subject of special issues of peer review journals, multiple textbooks, the subject of dozens of doctoral dissertations, and multiple symposia by professional associations. Based on Shulman's (1986) pedagogical content knowledge (which has also been diluted), the framework "attempts to identify the nature of knowledge required by teachers for technology integration in their teaching, while addressing the complex multifaceted and situated nature of teacher knowledge" (Koehler, 2019, under "TPACK Explained").

Authors who have described this framework suggest that technology in isolation cannot change learning outcomes. Rather, technology must be embedded in the context of deep knowledge and understanding of content and effective pedagogical practices for each discipline. The implication can be drawn that technology will be applied in different ways in different disciplines. Mathematics educators may use graphing calculators to develop understanding of mathematical concepts while history teachers may rely on primary online sources.

Large numbers of papers associating themselves with the TPACK framework are submitted to every educational technology conference. Yet, the well-deserved popular application of this framework has been diluted as it has been stretched and expanded. For example, a peer-reviewed journal with a high impact factor recently published an article that used TPACK as a framework. The authors used the term "generic TPACK" to describe cases in which technology is used in the same way in every discipline. The concept of *generic TPACK* is the antithesis of TPACK as originally published, ignoring the content domain (Mishra & Koehler, 2006) altogether. Once a concept is released into the field by the scholars who first identify or describe it, they lose control of the way in which it is used and applied.

Project- and Problem-Based Learning

Project- and problem-based learning have rich histories. Both learner-centered instructional strategies are traceable back to the early 20th century (Savery, 2006). Many variations of project- and problem-based learning are implemented even today, and the disciplines that implement project- and problem-based learning are broad, including medicine, mathematics, science, and social studies. Grant and Glazewski (2017) identified 12 components that can vary within project- and problem-based implementations. Due to these variations, these instructional strategies can become less well-defined, such as becoming less learner centered.

Project- and problem-based learning encompass a cycle, or process, for learning (Savery, 2006). Problem-based learning has a specific cycle for learning that is iterative, relies on cooperative groups, and revising solutions (Hmelo-Silver, 2004; Lu, Bridges & Hmelo-Silver, 2014). Project-based learning emphasizes an in-depth investigation during the production of a learning artifact (Grant, 2002; Krajcik et al., 1998; Krajcik & Shin, 2014). Project- and problem-based learning have been used in K-12 education through all grades and in higher education (Holm, 2011; Hung, Jonassen & Liu, 2008), so variability in implementation is to be expected.

In all of these implementations, the learning cycle needs to be explicitly defined. In both project- and problem-based learning, authors must operationalize the outcome of the cycle (e.g., product, solution, design, and diagnosis); the teacher, instructor, tutor, or facilitator's involvement; the learner's process for investigation or research and autonomy; types of hard and soft scaffolding; and types of supports and resources provided (Grant & Glazewski, 2017). These descriptions are critical to understanding where on Grant and Glazewski's continua an implementation may vary.

Self-Efficacy Instruments

Assessment instruments are particularly prone to conceptual dilution. There is a widely observed tendency to expand the boundaries of use beyond the specific purpose for which instruments were designed. For example, *self-efficacy* is a construct that is applicable within the context of a specific domain, such as "levels of a specific task (e.g., arithmetic progression problems), a course (e.g., algebra), or a more general domain (e.g., mathematics)" (Bong, 1997, p. 705). Aligning the specificity of self-efficacy measures with the specificity of performance is important (Bong, 1997).

Numerous instances of published self-efficacy research can be found where the (likely unintended) misuse of self-efficacy measures are too general, thus contributing to conceptual dilution. Self-efficacy is similar to other *self* constructs (see Bong & Skaalvik, 2003; Pajares, 1997; or Schunk, 1991), and cases have been noted where researchers have pushed conceptual dilution so far so as unknowingly to be discussing constructs other than self-efficacy.

Learning by Design

Learning by design is an approach to learning influenced by constructivist theoretical traditions highlighting the potential of design-based activities (e.g., Harel & Papert, 1991; Kolodner, 2002; Vygotsky, 1978). Scholars have used the learning by design paradigm in contexts like student learning, teacher learning, and higher education faculty learning. Many of the learning by design studies in teacher education are driven by efforts to position design as a legitimate professional activity. For instance, Kalantzis, Cope, and The Learning by Design Project Group (2005) highlighted learning by design as a crucial element of the education profession. These efforts typically attempt to reposition teachers' role from "distributers of information" to "designers of learning." This application parallels the role "teachers as designers" proposed by Mishra and Koehler (2006).

All of these efforts incorporate design as a central focus, but over time variability in both the design process and the resulting products has emerged. In some instances the design process has focused on lesson plans, while in other cases it has centered on technology-based solutions. More recently, the design process has focused on development of educational products using digital fabrication.

This variability is not inherently problematic. However, the term *learning by design* has been expanded to refer to any kind of learner activity that results in a product. The core elements of design – such as use of authentic, complex, and ill-structured problems, audience, collaboration, iteration, and reflection (Blumenfeld, Marx, Soloway, & Krajcik, 1996; Krajcik et. al., 1998) – are not consistently employed in these instances. As a result, the learning by design construct now has many different connotations. In some studies it is used to describe learning as a product of careful instructional design (e.g., see Yelland, Cope & Kalantzis, 2008), while in others is used to describe learning as it occurs through the design of artifacts (Koehler & Mishra, 2005). This example illustrates the way in which construct ambiguity may potentially confuse readers and could result in inconstant application and use across a body of work.

Mobile Learning

As one of the most recent technology-supported learning innovations, mobile learning, or mlearning, has grown and evolved over its short history. Early definitions of mobile learning by Winters (2006) were categorized as (a) technocentric, (b) examined in relation to e-learning, (c) examined in relation to augmented formal education, or (d) learner centered. Definitions were subsequently developed that consider mobile learning as mediation with technology (e.g., Han & Shin, 2016; Herrington & Herrington, 2007) or focus on the mobility of learners and learning (e.g., Kiger & Herro, 2014; Ng, Howard, Loke, & Torabi, 2010; Reychav, Dunaway, & Kobayashi, 2015).

The array of definitions that continue to emerge are problematic in some instances. For example, researchers and scholars, like Traxler (2010) and Krotov (2015), noted that definitions of mobile learning based in technologies are subject to obsolescence. Many definitions of mobile learning fail to distinguish it from earlier forms of technology-supported learning. Researchers, such as Koole (2009), have pointed out that definitions ignoring the sociocultural elements associated with mobile learning (such as the learner and the context in which the learning is occurring), do not distinguish it from other previous forms of learning. Definitions of mobile learning that fail to distinguish it from other forms of learning may be regarded as conceptual dilution.

Conceptual dilution has been particularly prevalent in K-12 education, as evidenced by increasing use of simplistic or trivial applications of mobile technologies. K-12 schools have been increasingly purchasing classroom sets or carts of mobile devices (e.g., Crompton, Burke, & Gregory, 2017; Grant et al., 2015) that shift the locus of control from the learner to the teacher. In these instances, the teacher determines when and how mobile devices are used (often in limited or constrained ways). In many instances, the mobile technologies are replacements for larger, less portable devices. These constraints reduce the potential educational benefits.

Technology potentially empowers students to collaborate with peers, create representations of their knowledge, and access help from peers, online sources, and their teachers. However, these uses are not unique to mobile learning: The device is not mobile across contexts; the learner is not mobile across contexts; and the context plays little importance in the learning. Most recently, Grant (2019) argued for disregarding definitions of mobile learning that may be faulty or diluted. Instead, he suggested a framework of seven design characteristics for mobile learning environments that identify the variations in implementations and affordances unique to mobile learning. These design characteristics are an effort to add more precision to describing mobile learning.

Blended Learning

Blended learning is another term has been employed inconsistently as it has gained popularity, resulting in ambiguity. The term has been used to refer to uses that range from technology integration to a wide array of methods employing the use of online resources (Osguthorpe & Graham, 2003). In addition, important distinctions can be drawn between the way in which the term is applied in higher education and in K-12 education. In higher education, blended learning is typically defined simply as the combination of "face-to-face instruction with computer-mediated instruction" (Graham, 2006, p. 5). However, computer-mediated instruction has become so ubiquitous it appears that most courses contain at least some computer-mediated instruction. In early publications researchers predicted that "we will eventually drop the word *blended* and just call it learning" (Graham, 2006, p. 7). In order to provide a more objective definition, universities often define blended learning based on the percentage of the in-class time that is replaced with online instruction. While these types of definitions are less prone to conceptual dilution, they focus on the structure and administration of blended learning rather than on the actual pedagogical benefits.

In contrast to higher education, K-12 blended learning definitions focus on pedagogical benefits. Currently, the leading definition for K-12 blended learning comes from the Clayton Christensen Institute and the *Handbook of Research on K-12 Online and Blended Learning* (Ferdig & Kennedy, 2014), which defines blended learning as "a formal education program in which a student learns at least in part through online learning, with some element of student control over time, place, path, and/or pace" (p. 9). The focus on student control is why blended learning is commonly paired with the concept of personalized learning — another concept that has been ill-defined and is susceptible to conceptual dilution.

One of the issues has been the multiple K-12 models that make up blended learning. K-12 schools and teachers have a high degree of supervisory responsibilities and typically cannot easily reduce class time. As a result, there is a greater range of K-12 blended models than in higher education. Blended learning can range from *rotation models* (including station, lab, and flipped models) with few online components to *flex models,* where the core instruction is online but it takes place within a physical school that has face-to-face support for students, to enriched virtual instruction, where instruction is nearly completely online (Horn & Stalker, 2011).

Clear, research-based definitions and frameworks are especially important to prevent conceptual dilution. Because K-12 blended learning is a relatively new concept, it is not surprising that the field has struggled to clearly define the term and develop conceptional frameworks. Graham, Henrie, and Gibbons (2014) explained, "Well-established scholarly domains have common terminology and widely accepted model and theories that guide inquiry and practice, while researchers in less mature domains struggle to define terms and establish relevant models" (p. 13). As expected, K-12 blended learning researchers have turned to well-established frameworks created for higher education, such as the Community of Inquiry framework. However, as Whetten (1989) argued, all frameworks have "boundaries of generalizability" (p. 492), and researchers should be cautious about applying frameworks developed in higher education to K-12 settings, due to important differences in the settings as well as student characteristics and needs.

Flipped Learning

Flipped learning (Bergmann & Sams, 2009) is one type of blended learning that has gained popularity when being applied to both K-12 school and higher education contexts, but it is yet another example of conceptual dilution where the use (or misuse) of the concept goes beyond its original definition. As noted in the previous section, flipped learning models are commonly associated with blended learning approaches but there are discrete differences to note especially within the context of a research study (Staker & Horn, 2012). As Bergmann and Sams (2014) noted, “There’s more to flipped learning than just asking students to watch videos at home and complete worksheets in class” (p. 18). Because flipped learning is a concept that lacks clarity in terms of the defined pedagogical approaches used to implement the approach, it is often misrepresented when applied and referred to in both learning and research contexts.

Flipped learning is a distinct pedagogical approach that uses technology in some capacity to assist with reversing what happens instructionally during a class period with what happens out of class. Typically, flipped learning involves moving direct instruction from the in-class group learning space to the out-of-class individual space; the in-class space then becomes a dynamic space where the teacher guides and assesses students’ subject matter learning (Flipped Learning Network, 2014). It is key that the in-class, face-to-face time becomes an environment that fosters student-centered learning that promotes a greater depth of content knowledge exploration. As might be expected, several frameworks have emerged that define the necessary steps or components for designing and implementing a flipped learning experience (e.g., Bishop & Verleger, 2013; Brame, 2013; Eppard & Rochdi, 2017; Karanicolas & Snelling, 2018).

Such frameworks typically provide helpful guidance for understanding flipped learning but also illustrate how conceptual dilution begins to occur as the concept gains momentum within educational contexts. It is of value to the research community that researchers provide a clear and rich description of the flipped learning activities used both in and out of class. Much of the research conducted on flipped learning investigates teachers’ and students’ perceptions of such environments (Bishop & Verleger, 2013). Further examination of other aspects related to flipped learning, such as the design and implementation of the flipped learning experience, how technologies are used to engage learners during the flipped learning experience, impact on student achievement, and the limitations and constraints related to using flipped learning, would be of value to the field as well.

Summary

These descriptions identify instances of conceptual dilution that frequently recur in submissions to educational technology journals. The editorial guidance provided to authors in such instances is also discussed. The intent is both to facilitate dialog about conceptual dilution and provide prospective authors with information that may lead to successful submissions.

Other terms and topics where conceptual dilution frequently occurs during submissions to educational technology journals include *learning analytics, computational thinking, mathematical modeling, mathematical knowledge for teaching, collaborative learning, personalized learning,* and *alternative assessment*.

It is important to distinguish between *conceptual dilution* and a *conceptual shift*. New data, research, and innovations lead to reexamination of existing models and frameworks, which in some instances can lead to adoption of an altered paradigm. This process differs from an unintentional expansion of a concept due to unfamiliarity with the concept or lack of a solid grounding in the prior literature. The NTLS Editors collectively note that often the original article is not referenced in the latter instance.

The goal of this work is to reduce introduction of unintended ambiguity into a concept or framework. Each of us welcomes articles focusing on reexamination and further development of existing frameworks or models. In such cases, the rationale and justification should be explicitly stated.

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