



# Online teaching and technological affordances: An experimental investigation into the impact of modality and clarity on perceived and actual learning



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## ABSTRACT

Online courses have become commonplace at many institutions of higher education. While the popularity on online courses is growing, there are still many questions regarding the effectiveness of such courses in facilitating learning outcomes. Using theories from mass communication and education, we designed an online lecture which employed a 2 (modality)  $\times$  2 (clarity) between-subjects factorial design to better understand how variations in the mode (text only; audio and text) and structure/clarity (high clarity; low clarity) of information impacted feelings of instructor closeness, credibility, and perceived and actual learning. Results indicated that online lectures presented in a multimodal format were better at facilitating positive student experiences with instructors, as well as perceived and actual learning than lectures that contained only one mode of information. Implications of these findings are discussed with a specific focus on instructional design and technology.

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## 1. Introduction

The recent attention online learning and instruction has received in higher education is not surprising given the opportunities that this method of instruction provides to institutions, faculty, and students alike (Konetes, 2011). Education research (e.g., Aragon, Johnson, & Shaik, 2002; Bassoppo-Moyo, 2006; Keegan, 1996; Ko & Rossen, 2010) has examined and outlined the importance of planning, time management, learning styles, assessment, and pedagogy in regards to developing online courses that are conducive to student success. However, in communication and related disciplines, few studies have examined how communicative and technological variables impact the effectiveness of online courses in terms of how they influence students' experiences and learning outcomes (see Allen et al., 2004; Bejerano, 2008; Carrell & Menzel, 2001). What is known in regards to communication within the online classroom is that many of the variables employed within the traditional classroom (i.e., face-to-face) to achieve student-learning outcomes (e.g., immediacy, motivation, engagement, interaction) are also linked to student-learning outcomes within the online classroom (see Carrell & Menzel, 2001; Conaway, Easton, & Schmidt, 2005).

Given the parallels between the two contexts and the explosive growth of online courses, it remains important to understand how variations in teaching strategy and technological affordances in online courses impact student success. Understanding how these common features of online courses contribute to effective instructor–student relations and learning outcomes will not only provide applicable suggestions for future online course development and delivery, but will also build a stronger understanding of best practices associated with online instruction and technology. Using the MAIN model and multimedia learning theory as theoretical frameworks and drawing on the literature from education, social presence and electronic propinquity, the current study seeks to understand how modality and clarity manipulations impact experiences of instructor closeness and credibility, as well as perceived and actual learning amongst students in a simulated online class.

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### 1.1. Multimedia learning theory, MAIN model, and experiences in online courses

Over the past five years, there has been a dramatic increase in the types of online courses offered by universities worldwide, and most institutions of higher education agree that this method of instruction will be critical to the future of education (Allen & Seaman, 2014). Online instruction encompasses any type of teaching that is assisted by or fully delivered via digital devices (e.g., computers), which act in support of the educational effort (Clark & Mayer, 2008). While financial issues facing many institutions of higher education and student demand are partly responsible for the shift to a more online-oriented instructional model, the overarching purpose of using online instructional methods is to “deliver instruction that can produce equal or better outcomes than face-to-face learning contexts” (Eom, 2011, p. 229). With this in mind, it is becoming increasingly important to identify which aspects of online instruction are effective in producing positive educational experiences.

Discussions about online teaching and learning are inherently tied to technology. Technology itself has advanced to a point where we no longer theorize about its potential to foster online learning. Instead, we conduct research to understand which media technologies are likely to be most beneficial in fostering and creating an environment that is conducive to learning. One way of understanding the specific impact that technology can have on student experiences and learning in online contexts is by breaking down technologies into their constituent “affordances.” From the human–computer interaction perspective, Gibson (1977) and Norman (1999) have conceptualized technological affordances as “action possibilities” or perceptual feelings that people form regarding how they are supposed to interact or use a given mass communication tool or technology. Utilizing and applying the “affordances” approach to the online learning context, may help to further disaggregate how specific features of technology may be impacting student experiences in online courses.

Recently, Sundar (2007; 2008) proposed the “MAIN” model and argued that four main affordances – modality, agency, interactivity, and navigability – are present in almost every interaction that occurs via digital communication technology. Further, each of these affordances has significant and separate impacts on the way that we consume and respond to digital content. In the online instructional context, these four main affordances are abundant. For example, modality affordances can include differences in methods of presentation of instructional content (e.g., text, audio, audiovisual). Agency affordances refer to the source of information (e.g., information provided by the instructor; user generated content; discussion forums). Interactivity affordances encompass any type of mechanism that allows users to dynamically impact or change content in a synchronous manner (e.g., online textbook, discussion, or chat session with real-time exchange or annotation). The final affordance, navigability, refers to ability that users have to move through or uncover information and is akin to the ability to find and use information in a meaningful manner (e.g., the way information is structured in an online course). Based on the examples given above, it is very intuitive to see how the sum total of interactions that individuals can have in an online course can be linked to each of these different technological affordances. Sundar (2007) and Sundar and Limperos (2013) theorize that although all affordances are perceptually and cognitively significant, the one affordance that seems to have the greatest impact on how information is received and processed in a digital environment is modality. Even though Sundar’s work is heavily focused on digital content generally, research in education and instruction suggests that modality, or more simply put, the way that information is presented in online courses is vitally important to student learning (Clark & Paivio, 1991; Mayer & Moreno, 2002).

When looking at the broader literature and research on education, the impact of modality on learning can be traced to early research, which investigated the effects of using audio-visual technology in the classroom (Lumsdaine & May, 1965). These early efforts to explore the impact of modality on learning primarily involved theorizing and investigating differences between face-to-face instruction versus instruction via video. In present day, the understanding of modality is slightly more nuanced. Video, audio, pictures, and text are modes, and modality refers to the channel through which a “mode” is processed (Downs, Boyson, Alley, & Bloom, 2011; Sundar, 2008). Deconstructing modality to its constituent modes allows for a more clear understanding of exactly how different presentations of information might impact student experiences and learning in an online course.

Different modes of information appeal to different modalities and the way that we process information from multiple modalities does have an impact on cognition and recall (Mayer & Anderson, 1991). While all online classes are not created equal, most agree that the strategies involved in online instructional are driven by information presented via multimedia formats (see Clark & Mayer, 2008). In fact, most new instructional tools that are created with online classes and face-to-face classes in mind are focused on fostering interaction and learning (e.g., CTools, MOOCs, and E-Text) through multimedia technological affordances. Therefore, understanding how different modes of information are related to student experiences and learning in online classes is important for discerning what constitutes effective instructional design in online contexts.

Recently, Downs et al. (2011) conducted a study focusing on iPods as a tool for the delivery of instructional material and found that students scored highest on a knowledge test (cognitive learning) when they were able to access lecture material that was multimodal (audio with text narration; audiovisual) in comparison to students who has access to information that was presented via a single modality (audio only). Similarly, Frisby, Limperos, Record, Downs, and Kercksmar (2013), found that multimedia information presented in a simulated online course was far superior in promoting perceived and actual learning than information presented via a single mode. Sundar (2007) notes that the presentation of information via different modalities does indeed impact how we perceive and respond to messages. This is likely due to the cognitive differences in the way that information is processed via multiple modalities versus a single modality. The dual-coding theory (Clark & Paivio, 1991) and the multimedia learning theory (Mayer, 2001; Mayer & Moreno, 2002) assert that people who receive information through a single format or channel (e.g., text only, audio only, or pictures only) process information in an associative manner whereas information that is presented in a multimedia format (all formats combined) tend to process information in a referential manner. According to Mayer and Anderson (1991) and subsequent research guided by these perspectives (see Mayer, 2001), referential processing is preferable to associative processing because information that is received, processed, and stored in a referential manner is far superior in terms producing learning outcomes than information that is processed in an associative manner. Taken together, the multimedia learning theory, MAIN model, and research informed by these frameworks suggests that the information presented via a combination of modes or appealing to multiple modalities should be better at facilitating learning than information which is presented via a single mode or modality, leading to the following hypotheses:

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