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THE INFLUENCE OF MULTIMEDIA PRODUCTION KNOWLEDGE
ON THE DESIGN DECISIONS
OF THE INSTRUCTIONAL DESIGNER

by

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A Dissertation Submitted to the Faculty of
Old Dominion University in Partial Fulfillment of the
Requirements for the Degree of

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INSTRUCTIONAL DESIGN AND TECHNOLOGY
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ABSTRACT

THE INFLUENCE OF MULTIMEDIA PRODUCTION KNOWLEDGE
ON THE DESIGN DECISIONS
OF THE INSTRUCTIONAL DESIGNER

Stephen Brent Hoard
Old Dominion University, 2016
Director: Dr. Jill Stefaniak

This study explored the interaction of multimedia production competencies of expert and novice instructional designers on the design decisions made during the instructional design process / workflow. This multiple measures study used qualitative survey instruments to access and measure the production competencies of participants, then a design aloud protocol to capture and measure the instructional design decision-making process for those same participants. A follow-on interview after the initial design aloud session was conducted in order to triangulate and confirm any trends or findings uncovered during the earlier design aloud session. Ultimately, the objective of this study was to provide some evidence that suggests whether certain production skills are influencing instructional design decision-making. Employer influence on the instructional designer's decision-making was also explored.

Results indicated that a substantial number of instructional designers ($n=30$) who participated in this study were selecting media as a preliminary step in their workflow process, and were often then using analysis as a measure to confirm the early media selection. Expert instructional designers appeared to be less susceptible to the early media selection behavior, though not immune. Results indicate that one reason the expert instructional designers were less likely to adopt media as a preliminary instructional design step was that the experts conducted a

more diverse set of analysis activities. Additionally, results indicated that instructional designers were often experiencing pressure to adopt media based on employer demands, and project constraints such as budget and time.

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This dissertation is dedicated to my wife, Liz, and my parents, Suzanne and Steve, without whose constant support and encouragement none of this would have been possible. This dissertation is also dedicated to Grandmom who was present for the start of my journey, and whose spirit continues to watch over my path now. Grandmom, you were the first to know that I had been accepted into graduate school, and I wish you could be here now. And, Grandpa, I made it.

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CHAPTER I

INTRODUCTION

At many organizations, the instructional designer is a busy and influential employee with many time commitments and resource constraints. To effectively manage within the time commitments and resource constraints, instructional designers who receive formal educations in the field are often taught to utilize instructional design models to contribute to efficient instructional design workflow, and intervention effectiveness. These instructional design workflows vary in complexity, and sequence – some are linear, while others prescribe a more iterative and concerted approach to intervention design and development. Regardless, steps pertaining to intervention development, implementation, and deployment are common features of most instructional design models.

Toward the end of producing interventions, it is understood that certain production competencies are commonplace among instructional designers (Ritzhaupt, Martin, & Daniels, 2010; Sugar, Brown, Hoard, & Daniels, 2011; Sugar, Hoard, Brown, & Daniels, 2011). For example, skill in the Microsoft Office suite of products, Techsmith Camtasia, Adobe Photoshop and general HTML capabilities were among the various production competencies identified by Sugar, Hoard, et al. (2011) and Ritzhaupt and Martin (2014) as common to the instructional design job advertisements. From studies on production competencies, we can assume that for many instructional designers, production and multimedia development are a component of workflow. The instructional designer is either the one producing the instructional intervention deliverables, or describing / controlling the means and methods used for producing the deliverables.

In terms of the overall instructional design workflow, the research literature shows that many instructional designers *do* base real-world project workflows on formal instructional design models, though often with some modification and potential stage omission (Rowland, 1992; Visscher-Voerman & Gustafson, 2004). The reasoning behind the departure from the established, written instructional design models is not always clear in the research literature, though there is some evidence that analysis stages are being glossed over or skipped entirely (Hoard & Stefaniak, 2016). Some instructional design work environments and practitioners might not be permitted the time and resources for a thorough front-end analysis, or perhaps are opting to rely on experience or some other mitigating factors to drive forward decision-making during the design phases of the instructional design workflow. Gibbons (2014) attributes variations to the instructional design workflow to the natural inclusion and evolution of the *design process* to include traditional and classical approaches, but also other creative approaches adopted from experience and other schools of design.

Within the realm of modifying instructional design models, this present research explored the effect of instructional design production knowledge on design decision-making. In other words, when an instructional designer made a decision to deviate from the established, written models, we attempted to uncover and display evidence relating to the rationale and the reasoning for the departure as a function of instructional design production knowledge (e.g., programming, multimedia development, video editing / shooting, web development).

Literature Review

The following literature review presents concepts central to instructional design workflow, and the degree and rationale applied to modifications of workflow beyond what might be expected using traditional instructional design models. Additionally, literature concerning the differences in practice between novice and expert instructional designers will also be discussed, along with an overview of existing research into the common production competencies of the instructional designer.

Instructional Design Models

Over the years, many instructional designers have published models of instructional design with the intention of describing and organizing the process through which instructional interventions are created. Instructional design models take many forms from the linear process to the iterative, non-linear, often with the intention of simplifying complex instructional design situations into more manageable conceptual frames (Branch & Kopcha, 2014). With the instructional design model, one primary goal is to inform and mold the overall workflow process into something efficient, manageable, and practical to the instructional design practitioner, while calling out and enumerating the various stages of systematic instructional design (Ryder, 1995). Ideally, the instructional design model is also responsive and sensitive to particular educational contexts, and accommodating of complex instructional scenarios and design problems (Branch & Kopcha, 2014). The degree of success in which the models do describe and influence efficient workflow in practice varies, and designers are not necessarily committed to a particular model for the duration of a project, workday, or career (Wedman & Tessmer, 1993; York & Ertmer, 2011). Certain research literature reports that practitioners will tend to migrate to, adopt and adapt instructional design models that best suit immediate business and project needs, often also

skimming through, or eliminating components of the model (Kenny, Zhang, Schwier, & Campbell, 2005; Wedman & Tessmer, 1993; York & Ertmer, 2011). Other researchers (Gibbons, 2014; Gibbons, Boling, & Smith, 2014) argue that the very definition of design can be adapted and scaled according to practitioner and project needs by drawing in capabilities, and approaches to problem-solving commonplace to other design-oriented fields outside instructional design. Considering a revised, or perhaps expanded, view of what *design* can entail in practice and theory instructional design might suggest a valid reason for the adaptation of instructional design workflow as seen in models. Kirschner, Carr, Merriënboer, and Sloep (2002) describe that instructional design models are definitely being adapted and molded in practice, suggesting real world *inspiration* (experience) is leading instructional designers to frequently adapt models, often on the fly. In the Kirschner et al. (2002) study, the deviations and adaptations to design models manifested in workflow modifications largely stemmed from the applied experience of the designers, meaning that prior knowledge of process application in their work setting guided the process used under observation in the study.

Design Decision-Making

At its core, the process of designing instruction involves making decisions. Among the decisions an instructional designer may potentially make involve defining audiences and instructional unit scope, selecting instructional strategies, and aligning project resources. The process by which those decisions are made may be influenced by prior experience (Ertmer et al., 2009; Ertmer et al., 2008; Kirschner et al., 2002) or by disciplines other than instructional design (Smith & Boling, 2009). Overall, the process by which decisions are made, and the outcome of decisions influence the progression and workflow of a project, and what resources are marshalled to complete an instructional intervention.

Winn (1987) points out that both the instructional designer and any classroom-based instructors may make decisions concerning instructional strategy. In this context, the instructional designer makes an initial assessment and decision concerning what instructional strategies are most appropriate for an intervention. The teacher is able to react to learner feedback to adapt the original instructional design to better suit real-time classroom conditions. Winn (1987) argues that an increasing quantity of instructional designs and instructional interventions may be deployed in situations where a teacher is not present, wherein one could assign an increasing degree of importance to the original decisions at the design phase of a project.

Mintzberg and Westley (2001) suggest that decision making might be distilled down into a succinct series of four stages wherein: a problem is defined; causes are diagnosed; possible solutions are considered; and one or more solutions are selected for implementation. Mintzberg and Westley suggest that such simplifications of a rational decision making process obfuscate more complex inner mental workings, and an iterative process of resource and problem re-definition, until the problem-solver *discovers* a final solution and decides on a course of action. Mintzberg and Westley are referring to an epiphany during design problem-solving, a moment during the course of scoping and examining possible solutions that the designer finds a solution and decides on a course of action that the designer intuitively knows will resolve whatever conditions existed within the original instructional problem. Deciding on solutions in this manner suggests a project workflow that may ebb and flow through various attempted solutions, and according to the *success* at which the designer has at discovering the final *solution* to a design problem.

Workflow of the Instructional Designer

Workflow and practice is going to vary from one instructional designer and work environment to the next; however, there are a few consistencies in instructional design project workflow detailed in the research literature. Rowland (1992) discusses how *typical* workflow for the instructional designers in Rowland's study was non-linear, and iterative. Gray et al. (2015) recently acknowledged that a non-linear, iterative workflow is a common configuration used to address instructional design work. Instructional designers tended to skip around in the sequence of instructional design activities at will, and as necessitated by project requirements; and often repeated completed instructional design tasks as new information dictated. Research from Roytek (2010) spotlighted a similar non-linear, iterative approach to instructional design. The designer might complete an analysis stage quickly, and later returns for a deeper and more thorough examination of data and findings after completing such late stages of project workflow as development and implementation.

Given the data on the practical workflow of instructional designers, certain researchers have levied criticism on the formal instructional design model as an effective description of the instructional design process. For example, Visscher-Voerman and Gustafson (2004) discuss that instructional design models and workflow *as envisioned in theory* tend toward the homogeneous and linear, and are very *ADDIE-esque* in appearance and function. Gray et al. (2015) also comment on how many instructional design models have, at a high-level, become indistinguishable from one another. Ultimately, it is argued by Visscher-Voerman and Gustafson that these homogenous and linear instructional design models tend to limit and provide inadequate space for the instructional designer to adapt and flow with project demands. In practice, instructional designers appear to be aware of how much their *actual* design practices deviate from the published models (Gray et al., 2015), though the experienced instructional

designers do tend to attempt to rationalize the deviations from the expected norm in the models (Visscher-Voerman & Gustafson, 2004).

Differences between Expert and Novice Workflow. In terms of studying experts versus novices, there have been varying approaches to categorizing research participants. In Rowland (1992), research participants were selected and categorized on the basis of peer recommendations. Rowland reports that the experts in his study possess between seven to over twenty years of experience in the field of instructional design, but relies heavily on the advice of other instructional designers to confirm the expert status of his participants. For novices, Rowland accepts students of instructional design at a local university, but does confirm that none of the novices had more than a single experience with instructional design. Instead of relying on the arbitrary judgments of external reviewers to identify expertise, it might instead be appropriate to designate *expertise* as being related to some threshold number of hours of experience. In a widely cited study, Ericsson, Krampe, and Tesch-Römer (1993) establish a 10,000 hour of deliberate practice benchmark for the emergence of expertise. Within those 10,000 hours, it is postulated that the developing expert will acquire domain-specific experience, mental schemata and psychomotor capabilities to maximize task performance. Adapting that 10,000-hour threshold to the world of full-time instructional design employment yields a timeline of at least between 4 to 5 years of full-time employment (assuming 50 weeks of work per year and 40 hours of work per week) to attain maximal task performance, or expertise. Ertmer et al. (2008) adopted a similar scale threshold for categorizing experts from novices in their study of instructional design problem-solving.

A somewhat more concrete approach to recognizing expertise might be to use the expert attributes as described by Chi, Glaser, and Farr (2014). They describe expertise as domain-

specific, and related to speed of accurate task performance. Further, Chi et al. explain that the expert can perceive large overall patterns in a problem, and manage working memory for the tasks in which expertise has evolved, suggesting the development of automaticity in certain sub-tasks. Chi et al. also suggest that experts examine problems at a deeper level than do novices, and also use metacognitive strategies to monitor against errors. Naturally, these classifications of expert attributes lend more to external observation to qualify the expert, or the same self-selection or peer-recommendation approach utilized by Rowland (1992). By defining the characteristics of the expert using the attributes from Chi et al., the process of categorizing experts from novices might be made more reliable.

The degree to which the instructional designer can anticipate, adapt and mold workflow to meet project demands is a function of experience, so there may be consistent differences in practical workflow of the experienced versus novice instructional designer. For example, more experienced designers may be more inclined to use an iterative approach to analysis, design and evaluation, whereas the novice designer might tend to use a less iterative, more linear design approach. The research literature reinforces this difference.

Rowland (1992) describes a *zig-zag* approach to instructional design workflow that is far more prevalent in experts than in novices. With the *zig-zag* approach to instructional design, the experienced instructional designers reacted to and adapted to project demands much more fluidly, and were more apt to return to and revise work produced in earlier phases of the instructional design process than were novices, particularly in phases relating to analysis. The design process employed by the experts in Rowland's work could not be described as linear, but rather in the more complicated *zig-zag* pattern. In contrast, Rowland found that novices tended to accept instructional design assignment details and problem statements at face value, and failed

to deeply engage in analysis (or skipped analysis entirely), resulting in a more direct and linear approach to problem-solving. Ertmer et al. (2008) discusses a similar effect among novices who fail to deeply analyze a problem, and synthesize the core instructional issues in a project.

Novices tended to deal with issues piecemeal and ad hoc, and as the issues presented instead of thoroughly analyzing the nature of the problem, its components and relationships to the learners and stakeholders.

The experienced instructional designers have learned to conduct front-end analysis, but can adapt instructional design processes and material on the fly as new interpretations, nuance or additional information is uncovered. In contrast, novices tended to move through analysis linearly and, once completed, failed to return to the analysis phase to update and revise project planning or overall workflow when presented with confounding, new (or initially missed) detail. Kenny et al. (2005) discuss this effect in that experienced instructional designers tend to rely on prior experience to adapt workflow, and will chart individual courses during a project timeline or workflow separate from what a formal instructional design model might prescribe. Often, according to Rowland (1992), this amounts to a complex and branching approach to project workflow, based on anticipated conditions and decision points later in the project. For example, the designer may not be able to anticipate a fairly specific condition of the deployment environment, and might plan for two options, where one option might be ideal for a certain environment and the other option might be ideal for another potential environmental condition.

Yet, despite the variations, it is clear that the instructional designer is often using an instructional design model as the basis for project workflows, however the *actual* workflow might ultimately be modified (Ertmer et al., 2008). Though the project flow might be out of sequence relative to a formal model, the experts are tending to still achieve all the various

milestones of the systematic design process. Even the novice instructional designers appear to be following an *ADDIE-esque* design approach to the same ends (Rowland, 1992; Visscher-Voerman & Gustafson, 2004).

The research literature demonstrates that experts tend to rely on prior experience (or, as Rowland termed, “schematics”) for instructional design, and provide branching problem solution outlines for different conditions that may vary somewhat from the prescribed instructional design model approach. Rowland shows that this branching and complex workflow and project planning is amplified in situations where instructional problems are poorly defined. According to literature, novice instructional designers do not attempt that degree of workflow complexity (Visscher-Voerman & Gustafson, 2004), and do not always detect poorly defined instructional problems by virtue of a lack of experience (Rowland, 1992). For the experienced instructional designers, however, the systematic and concerted approach to defining and refining project goals, outcomes, and workflow can easily be seen as a strength, leading to potentially more targeted and structured instructional interventions.

The propensity for novices to skip or skim over in analysis has already been discussed, and is an obvious point of struggle for the instructional design field, at least among novices. In terms of under-engagement of analysis tasks, Christensen and Osguthorpe (2004) discuss a tendency among the instructional designers in their study to offload certain analysis-related project responsibilities to subject-matter experts and project stakeholders. Obviously, the individuals being asked to take on the analysis tasks were not necessarily trained in the appropriate approaches for the analysis to be thorough or accurate. The finding from Christensen and Osguthorpe (2004) dovetails with Visscher-Voerman and Gustafson’s (2004), which also found that instructional designers tended to outsource many micro-level design

decisions to subject-matter experts and project stakeholders. These early decisions at the analysis stage certainly inform and modify later learning outcomes, project materials and overall design decisions. One concern with the outsourced approach is whether the individuals being asked to make decisions and handle analysis tasks are qualified to do so, and are able to proceed without bias.

Christensen and Osguthorpe (2004), and Visscher-Voerman and Gustafson (2004) discuss the outsourcing approach to project decision-making and analysis as having roots in resource conservation. The instructional designer is doing what the designer must to stay on top of projects. It would seem that the outsourcing of certain decision-making tasks is a factor of too few hours and too many project responsibilities.

Of course, to compensate for resource constraints such as like shortages of time, methods for making the instructional design process more efficient has been discussed. For example, Roytek (2010) suggests implementing rapid prototyping to increase efficiency in instructional design, where full instructional design cycles are viewed as costly. Roytek suggests using an early prototype to help drive overall decision-making and workflow during the instructional design project. Along the same lines, the approach of delivering an instructional design project as *just good enough* or *good enough for now* is another approach advocated for making the instructional design process more efficient and less resource hungry (Gayeski, 1991). For example, a highly capable programmer might be able to produce a world-class project deliverable, but at the cost of a considerable salary and time. Alternatively, a *good enough* deliverable directly from the instructional designer might not have the same visual flair or finish and flourish as the one produced by the programmer, but the *good enough* product might suffice in attaining learning goals.

Resource constraints may lead a designer attempting a *good enough* implementation step to still fall short of fully exploring a range of solutions (Visscher-Voerman & Gustafson, 2004). Indeed, the outcome of such an approach might be to rely on old known strategies for development and implementation such as templates regardless of whether or not the known development / implementation strategy is a good fit for the present project. Roytek (2010) discussed this tendency to adopt and mandate the use of template product deliverables as a matter of cost. The cost for custom designing each instructional product user interface presents some of same time concerns that lead to the outsourcing of analysis tasks.

Roytek calls attention to the tendency in these template scenarios for evaluation to become a casualty too. As Roytek explains, product evaluation might not happen at all as the time and resource constrained instructional designer might assume that evidence of previous template-based designs succeeding implies a high probability of success on new designs based on the same template.

Relating to the template approach, there may be another tendency of the designer to fall behind on implementation technologies and strategies. As the instructional designer is rushing from one project to another, it may also be difficult to find the time to keep up with new implementation approaches and technologies (Christensen & Osguthorpe, 2004).

Development Competencies of the Instructional Designer

Roytek (2010) suggests that instructional designers have at least some basic background in development. Knowing the basics of development allows the instructional designer to skip questions pertaining to feasibility and focus on questions regarding the costs associated with development. The proposition is that possessing some basic development knowledge can keep project costs under control and away from time / money sinks within design decisions (Roytek,

2010). Of course, other researches have explored design and development activity further, and have identified specific authoring technologies on which competency is recommended (Daniels, Sugar, Abbie, & Hoard, 2012; Ritzhaupt & Martin, 2014; Ritzhaupt et al., 2010; Sugar, Hoard, et al., 2011). Fundamentally, the implication is that the instructional designer presents a far more rounded team-member and a potential cost-saver to the employer when in possession of competency on various authoring toolsets.

Relationships between Accepted Competencies and Workflow

The research literature demonstrates that the full, formal instructional design model is often not being fully utilized in practice, whether out of novice ignorance of the correct approach, or a lack of resources. Furthermore, research also highlights that certain approaches to making the overall, formal instructional design model are more efficient and more likely to be integrated or used in practical workflow. Some of the methods suggested for making instructional design more efficient assume some development responsibility for the instructional designer in the form of rapid prototyping, *good enough* development. Yet, the extent to which instructional designers are currently capable of meeting the production competency requirements of the suggested efficiency boosts is not fully known, nor is the extent to which the instructional designers might utilize such competencies during earlier phases of project workflow. The present study will attempt to provide data and findings related to these questions.

Knowledge Elicitation and the Speak Aloud Protocol

Fundamentally, the data gathering method used in Rowland (1992) can be categorized as a speak aloud or think aloud protocol. Rowland's participants were given an instructional design scenario that involved the setup and repair of machines, and were asked to expound on their thoughts about the scenario in order to ascertain process and task orientation to the scenario.

Typical speak aloud or think aloud protocols involve a researcher posing a problem or a statement to a participant with the instruction that the participant expose thought and cognitive problem-solving process to the researcher by speaking their thought process out loud. The speak aloud process is generally recorded verbatim through electronic means, or by way of summary notes written by the researcher during the session. The record of the session is later analyzed by the researcher. Ideally, the speak aloud session is repeated with multiple participants in order to confirm and triangulate any findings that might be derived from the process.

Limitations of Speak Aloud Protocols

The speak aloud protocol as a research method is not without limitations. As the protocol exposes thought and cognitive process and does not necessarily include any directly observable behaviors, the method might be mistrusted by behaviorists, according to Ericsson et al. (1993). Command of a spoken language is also a profound barrier to participation in a speak aloud study, where available experts might speak languages other than those preferred by the researchers (Van Someren, Barnard, & Sandberg, 1994).

Additionally, the protocol has also been criticized for its resource intensiveness (Burton, Shadbolt, Rugg, & Hedgecock, 1990). The protocol requires that the researcher present a problem to individual participants and have them verbalize their internal thought and decision-making process. Those verbalizations must be captured, cataloged and analyzed manually, requiring a great deal of time commitment from the researcher. The nature of the protocol requires direct access to multiple experts who may be committed to the research process for extended periods. As such, the protocol might preclude the participation of certain experts due to outside time commitments, yet when compared to other methods of knowledge elicitation, the

speak aloud protocol compares favorably in terms of depth and thoroughness of findings as opposed to card sorting or unstructured interviews (Burton et al., 1990).

Although true with other forms of knowledge elicitation, Burton et al. (1990) suggest that the speak aloud protocol may collect absolutely specific info from experts that is applicable to a very narrow setting, environment or situation. For example, an expert might know the *trick* to get the office photo copier to work without errors, but that same *trick* might be due to a specific malfunction on that particular photo copier machine. Any knowledge or heuristics built around that *trick* may not apply outside the expert's immediate setting, where the photo copiers might be free of whatever malfunction causes the problem in the expert's own setting. When confronted with suspect information such as in the aforementioned photo copier example, researchers offer that probing or redirecting during the speak aloud session will negatively impact the data gathered (Wright & Ayton, 1987). The data produced by the speak aloud protocol should ideally be free of the influence of the researchers, where the researchers have not presented leading questions to the participants or *put words in the mouths* of the participants.

Experts versus Novices. Naturally, the speak aloud protocol will yield different results between experts and novices to the tasks used during the sessions. As might be expected, experts will attend sessions with a deep understanding of subject matter, and potentially complex problem-solving behaviors, whereas novices will present with shallower understandings and potential haphazard problem solving approaches. The rate of recall of information may also be higher among experts due to enhanced semantic linking between concepts and principles without the body of knowledge being examined (Cooke, 1994; Wright & Ayton, 1987).

In terms of data gathering, Burton et al. (1990) suggest segregating experts and novices into separate data pools as to reduce the background noise the relative novices introduce during

speaking aloud sessions. That is to say, the background noise may occlude themes or central tendencies if mixed in with the data gathered from true experts. The data from the relative task novices is not without value however, and it is possible to glean heuristics and knowledge from speaking aloud sessions with the novices too. Burton et al. (1990) suggest analyzing the two groups (novices and experts) separately though. In terms of selecting research participants, Burton et al. (1990) suggest that access to relative novices may be more easily obtained than access to true experts due to the time of the best experts on a topic may be prized by employers and managers.

Automaticity. Experts have experience, and have likely become quite efficient at problem-solving within their domain – even to the point of automaticity on many tasks. The knowledge elicitation process attempts to access the advanced problem-solving ability of those experts, and expose the heuristics and processing that is occurring during problem-solving – even during automaticity (Van Someren et al., 1994; Wright & Ayton, 1987). While the degree of mastery and automaticity may make the expert very efficient and effective at a certain task, the same mastery and automaticity may have a deleterious effect on the effectiveness of the speaking aloud process of knowledge elicitation. The expert may not be able to articulate why certain things are done during a problem-solving process (Wright & Ayton, 1987). Rather, experts may react to inputs and other environmental variables automatically based on sight or feel versus conscious thought.

Van Someren et al. (1994) also discuss a vexing issue with knowledge elicitation in that experts have purposefully adjust their reported thought process during a session in order to maintain secrecy due to concern for job security, or in an effort to conceal short cuts that might be perceived as cutting corners or violating policy. Paradoxically, a similar situation may exist which the expert will excessively speak in order to demonstrate prowess, and will demonstrate a

different cognitive and problem solving approach than they actually use. As such, the speak aloud protocol may be apt to capture fake data from certain experts.

Cognitive Load and Personal Conditions. Fundamentally, the act of speaking during a speak aloud session adds a layer of extraneous cognitive load to the problem-solving process, and may influence the thoroughness, timing or correctness of participants (Cooke, 1994, 1999; Wright & Ayton, 1987). The very act of participating in a speak aloud study affects the cognitive process of experts and novices, and alters what findings the researcher may gather from the sessions. Wright and Ayton (1987) suggest designing sessions such that participants can engage in the tasks being studied is ideal. Prompts and real process can ground the participant, and help to mitigate the effect of forgetfulness or the glossing over details that might be the result of heavy load on working memory caused by simultaneously handling the need for dialog *and* problem-solving actions. Van Someren et al. (1994) also suggest that emotional state of the participant can influence the effectiveness of the speak aloud session.

Van Someren et al. (1994) advise carefully managing the difficulty of the tasks used during a speak aloud session. The researchers discuss that the activity used for the basis of the speak aloud session should be difficult enough to be meaningful and representative of the tasks, but not so difficult so as to confound. Wright and Ayton (1987) caution that experts may have a tendency to stop talking through their thought process when under heavy cognitive load due to the processing significant task demands.

In spite of the challenges with the speak aloud protocol for knowledge elicitation, the method is still common to the research literature for its relative low-cost of administration, and its effectiveness at gleaning expert and novice knowledge relating to decision-making and process navigation workflows. The speak aloud can be a direct means of measuring and

detecting internal thought-process related to problem-solving, and it does not necessarily require the measurement, observation or interpretation of example participant behaviors as a lone data source. It is also adaptable to a range of environments and can be easily administered remotely making it ideal for use in studies in which the participant pool is geographically dispersed.

As a Mode of Analysis

As a data source, Cooke (1994) suggests that the speak aloud protocol should ideally be partnered with a second round of data gathering to triangulate and confirm findings from the initial round of knowledge elicitation. To meet this aim of triangulating findings, Cooke (1994) and Ericsson and Simon (1992) offer up that unstructured, follow-on interviews (e.g., after-action debriefings) with participants are one acceptable option. A researcher may use the follow-on interview to confirm or ask for additional exposition on why a certain decision or thought process was reported in the initial speak aloud session. Van Someren et al. (1994) caution, however, that such a follow-on interview may prove of limited value if participants are unable to remember why a certain decision was made. As such, it may be important for any subsequent follow-up to the interview occur immediately or after only a short interval after the initial session. Both Van Someren et al. (1994) and Ericsson and Simon (1992) recommend recording speak aloud sessions, or somehow producing an exact transcript of the events to act as hard data during analysis. This approach stands in contrast to alternative methods of data collection that might rely on researcher notes or analysis produced during the speak aloud session. Methods that rely on research interpretation or summarizing during the speak aloud session might be prone to skewed data or researcher bias, and would be difficult to use for any external review.

When reviewing transcripts or recordings, it has been suggested that researchers should listen for the core cognitive process / problem-solving heuristics, and to discount inner speech

and verbal static that may be present in the data (Ericsson & Simon, 1992; Wright & Ayton, 1987). Participants may tend to *fill the dead air* with non-useful commentary, and effectively bury actual cognitive processes.

Summary

The body of research supports the notion that instructional designers are adapting and deviating practical instructional design workflow beyond what may be described in many instructional design models (Rowland, 1992; Wedman & Tessmer, 1993). Experience and practical resource constraints appear to be among the most influential factors when instructional designers do modify and adopt individualized instructional design workflows (Visscher-Voerman & Gustafson, 2004). So, as a result, many instructional designers are adapting and implementing practical instructional design workflows that best fit the constraints of their specific workplace or work environment.

Other lines of research indicate that the analysis phase of the instructional design workflow may be often reduced or eliminated from the individualized instructional design workflows (Hoard & Stefaniak, 2016). And, on the same token, other research has indicated a degree of importance to multimedia production knowledge among practicing instructional designers (Ritzhaupt & Martin, 2014; Ritzhaupt et al., 2010; Sugar, Brown, et al., 2011; Sugar, Hoard, et al., 2011), and further suggesting that production knowledge can have an effect on workflow (Roytek, 2010). The extent to which the production knowledge effect influences the individualized workflow has yet to be examined.

Purpose of Study

The design methods and workflow of the instructional designer have been the subject of study and have been described both in and with instructional design models. Additionally, the

production competencies of the instructional designer have also been the subject of study. Yet, the potential influence of those production and development skills on the design decisions of the instructional designer has not been the subject of much examination. The present study was designed to inform that gap in the research literature by providing insight and evidence for the effect of development knowledge on instructional design decision-making and overall instructional design workflow. The influence of the employer on decision-making and overall instructional design workflow is also examined.

Research Questions

The present study assumed an instructional design workflow that followed the analysis, design, development, implementation, and evaluation phases of instructional design, and attempts to outline the impact of multimedia production skills therein.

Q1 : At what rate does an instructional designer's development knowledge influence interpretation of analysis findings, or overall design and implementation decision-making?

Q2 : To what degree does instructional designers' development knowledge influence the design decision making and instructional strategy selection for a particular ID project?

Q3 : To what degree is overall instructional design experience a factor alongside production knowledge on the design decision making and instructional strategy selection for a particular instructional design?

Q4: To what degree is the instructional designers' employer influencing media selection, design decision-making and instructional strategy selection?

CHAPTER II

METHODS

Research Design

This is a quasi-experimental, multiple methods study. Participants were first queried about their instructional design development competencies. A design aloud protocol followed, during which participants demonstrated their approach to instructional design problem solving. A follow-on interview was conducted following the design aloud protocol, which allowed the primary investigator to discuss the design aloud session with the participant and ask for clarification about design decisions as related to any development skills noted earlier in the process.

As is the case with the instructional design workflow and decision-making studies from Rowland (1992) and Ertmer et al. (2008), this study was designed to use a speak aloud protocol of capturing instructional design decision-making strategies and rationale, adapted here into a design aloud protocol. Participants were presented with a consistent instructional design scenario (Appendix B) for the design aloud session, and they were asked to verbalize their thought and decision-making process for the provided scenario.

Participants

Following the model established in Rowland's 1992 work concerning instructional design workflow, the present study was constructed to include the participation of both expert and novice level instructional designers. As Rowland's work does not supply a strict delineation between the expert and novice level instructional designer, the present study separated expert from novice thusly: full-time instructional design practitioners with between 0 to 4 years of experience will be considered novice, and those with greater than 4 years of experience will be considered expert. By fixing the delineation at 4 years of experience, the present study adopted

the approximately 10,000 hour benchmark from Ericsson et al. (1993). To confirm novice-expert categorical placement, the participants will be queried to qualify expert-like behaviors per the attributes identified by Chi et al. (2014): presence of automaticity / speed of task performance relative to peers, accuracy, depth of analysis, pattern recognition, and self-monitoring skills. Additionally, segregating the expert and novice users into discrete categories during data gathering and analysis follows the recommendation of Burton et al. (1990) for design aloud protocol. Separating the experts and novices into discrete data sets will reduce skew, and improve reliability of data (Burton et al., 1990).

Participants were recruited from the membership of both the Association of Educational Communication Technology (AECT) and The International Society of Performance Improvement (ISPI), two large professional societies in which membership is common among instructional designers. A solicitation for participation was made via email to the membership of both organizations. Participants were invited to a web-based video conference setup as the means of interacting with the study, and there was no travel requirement. The recruitment goal for the present study was 30 participants, which was attained. By recruiting 30 participants, the study more than doubled the sample size from the Rowland (1992) study and also stood in line with the sample sizes obtained by Burton et al. (1990). A sample size of 30 improved on the generalizability of the findings from this study versus those in the Rowland work, which used a smaller group.

To be included in the study, all participants were required to possess the following:

- At least some fulltime instructional design experience
- Knowledge of instructional design process, though no particular credential was requested (e.g., a college degree in instructional design, professional certifications).

- English-language fluency, and the ability to communicate orally
- A computer and Internet-connection sufficient to sustain the video conference tool (i.e., Skype and Adobe Connect)

An attempt to reach practitioners in various time-zones was made, and there was international participation in the study.

Data Collection Instruments and Validity

In terms of face validity of the multimedia proficiency questionnaire (Appendix A), it is important to note that the content is based on the data from several studies on the topic of instructional design production and development competencies (Ritzhaupt et al., 2010; Sugar, Brown, et al., 2011; Sugar, Hoard, et al., 2011). The data collection instrument was reviewed and revised by outside reviewers. For the purposes of this study, the primary investigator requested the expert review from two experienced instructional designer professors, both of whom have been routinely published on the topic of production competencies of the instructional designer. The professors were asked to first review the studies of production and development competencies, and then to review the technical proficiency questionnaire within the lens of the production and development competencies presented in the research articles. The reviewers were asked to compare content of the questionnaire to the studies, and to affirm or revise the instrument to more closely match the identified competencies from the literature. The process of critique required two rounds of revision before the reviewers were satisfied that the questionnaire instrument reflected the results of the existing literature.

Each participant was also presented with an instructional design scenario (Appendix B), and given the task of discussing the participant's approach to resolving the instructional design problems within the scenario. The participant's comments were recorded, transcribed and then

coded according to what stage of the ADDIE process each comment represented. When the code pertained to analysis activity, another code was applied to describe the type of analysis activity being performed. In terms of validity for the coded interview data, the recordings and groupings were made available to an external reviewer, along with the initial reviewers notes concerning how and why groupings were constructed. The reviewer was asked to examine the content of the segments, and appraise how the content and thematic groupings were arranged. Naturally, the reviewer was invited to offer criticism and revisions to how the thematic groupings were arranged, and recommended revisions or reorganizations were applied. If any situations occurred in which the external and the primary researcher were unable to reach consensus, a third, objective reviewer was available to examine and review the topic of contention between the first two parties.

Procedures

As has already been mentioned, primary data collection occurred via a web-based teleconference with study participants (Skype and Adobe Connect). Over the course of 30-minutes, participants were asked to review an instructional scenario, and to design aloud while strategizing about the steps and process each participant would use during the course of the project. At the beginning of the session, the researcher explained the purpose of the research study, and the design aloud protocol (i.e., that the participant should verbalize all thoughts pertaining to the project and decision-making processes). The researcher emphasized that there is no right or wrong way to approach the instructional scenario, the researcher was most interested in the process and workflow that the participant would use. Additionally, the researcher underscored with the participant that the researcher was an observer only to the process (Ericsson & Simon, 1992), and would not be able to respond to or answer any questions

pertaining the instructional scenario or the course of action the participant took for their workflow design. Each teleconference session was video recorded, and stored for later analysis by the study researcher.

Prior to entering the web-based teleconference setting, each participant was also asked to complete a self-assessment of production knowledge and authoring tools, based on the identified production and tool-related competencies found in Sugar, Brown, et al. (2011), Sugar, Hoard, et al. (2011) and Ritzhaupt et al. (2010). The instrument took the form of a checklist that the participant used to indicate knowledge in a particular topic, but a Likert-scale was also provided so the participant could indicate a depth of knowledge on the known topics. Space was also provided such that the participant could introduce or add additional competencies that were *not* already present in the instrument. In this way, the goal was to uncover and analyze any novel competencies and skills that the participants might introduce to the study.

While participant names and contact information were necessarily made available to the researchers during recruitment, this basic biographical information will not be reported. The self-assessment tool gathered information pertaining to the number of years of experience of each participant, along with the ranges for the two experience categories and an accounting for the geographic ranges for the participants, and this experience and geographic data will be reported. The technical and production / development level knowledge of each participant will also be reported via data from a self-reporting survey tool.

According to Burton et al. (1990), Van Someren et al. (1994) and Wright and Ayton (1987), a follow-on interview may be conducted after a design aloud data collection in order to triangulate and confirm the validity of any initial trends or findings. As such, the present study conducted follow-on interviews with the participants immediately following the conclusion of

the design aloud protocol in order to clarify and confirm details from the design aloud protocol. The researchers used the follow-on interviews to ask *why* the participant reported certain design decisions during the initial session, and to otherwise probe the workflow the participant used during the design aloud session.

Data Analysis

This study used the same protocol as the one used in Rowland (1992) and as discussed in Burton et al. (1990). The primary source of data for the study was the recorded teleconference sessions. The verbal content from each session was reviewed and segmented, just as Rowland did, at the verbal breaks of conversation (i.e., pauses, intonations, syntax markers, and subject changes). The individual segments of design aloud session were evaluated for content and topic by the study's primary researcher, and grouped according to overall theme of the segment. Segment thematic groupings were combined and reassigned as more sessions were reviewed with the goal of winding up with overall thematic categorization for novice and expert segments in the data pool, in addition to overall themes from all participants. Individual thematic rates will be reported, along with the overall thematic occurrence rates among all participants and then along the boundaries of the novice and expert groupings. Careful attention was paid to thematic groupings referencing or utilizing production and development skills and knowledge.

Parallel to the thematic categorization / grouping effort for the recorded design aloud sessions, the researcher also investigated the technical production and development questionnaire data. For each participant, the researcher noted in which production and development skills the participant has indicated proficiency and knowledge. The overall incident rate of specific technical production and development skills will be reported, along with the breakdown according to experience level (novice versus expert). On an individual basis, the researcher

listened for and flagged any mentions of the specific production skills from the questionnaire in the design aloud session in order to detect how often and at what point the production skills were introduced into the design aloud session. For example, a participant might have indicated that a particular project deliverable might be created in TechSmith Camtasia or other video-editing software. The mention of a particular product or deliverable approach was noted in combination with how the participant responded on the technical skills questionnaire. Of course, the researcher also noted any technical production and development skills mentioned or inferred in the design aloud session that were *not* referenced in the questionnaire, and will report on any discrepancies.

Further, the researcher related the correlation (or lack thereof) for themes and production competencies in the design aloud protocol with explanations and trends discovered in the follow-on interviews. For example, a participant might have mentioned the use of TechSmith Camtasia during the design aloud protocol, but during the follow-on interview suggested that the use of the tool is related to availability at his/her workplace and that a different tool might have been used at a previous job. As such, the researcher mentioned that the use of Camtasia during that particular design aloud session apparently had less to do with the tool and more to do with the production process it represents – e.g., video production for Camtasia. In this manner, the extent to which individual *tools* are influencing design decisions can be explored and qualified versus the production *competency* the tools represent (e.g., TechSmith Camtasia or Adobe Premiere for video production; Dreamweaver for web design; Audacity for audio production).

The first research question explored: at what rate does an instructional designer's development knowledge influence interpretation of analysis findings, or overall design and implementation decision-making? For this question, the results of the self-reported production

knowledge questionnaire are compared against the results of the design aloud session. Where the production knowledge questionnaire from an individual participant identifies a production skill used in the same participant's design aloud session, this incremented the count for influence of the production skill. Three separate counts were used for influence heard in the analysis findings, design decisions and implementation decisions. An overall incident rate was also calculated as the sum of the three separate counts, and will be reported alongside the three separate counts, which answers the incident rate thrust of the research question.

The second research question explored: to what degree does instructional designers' development knowledge influence the design decision making and instructional strategy selection for a particular instructional design project? The incidence rate of influence, as detected during the recorded design aloud sessions, was the primary data for establishing the degree of influence. In the follow-on interviews, the occurrence of influence was confirmed with the participants, and the participants were asked to expound on the effect of the influence, which triangulated the incident rate findings from the first round of interviews.

The third research question explored to what degree is overall instructional design experience a factor alongside production knowledge on the design decision making and instructional strategy selection for a particular instructional design? The self-reported production knowledge questionnaire queried the participants on work experience as an instructional designer. As has already been discussed, the work experience question was used to separate the participants into experienced and novice sub-groups, between which the effect and incidence rate of development knowledge influence can be compared between novices and experts in the study participant pool.

Table 1

Research Questions with Respective Data Sources and Analysis Approach

Research Question	Data Sources	Analysis
At what rate does an instructional designer's development knowledge influence interpretation of analysis findings, or overall design and implementation decision-making?	Design aloud sessions Follow-on Interviews (Triangulation)	Thematic analysis of design aloud sessions and confirmation in follow-on interviews uncovers the rate of occurrence of influence.
To what degree does instructional designers' development knowledge influence the design decision making and instructional strategy selection for a particular ID project?	Intake questionnaire – Production knowledge questions Thematic analysis of design aloud sess. Follow-on Interviews (Triangulation)	Correlation b/t incidence of reported production knowledge (and self-reported degree of expertise) versus influences in design aloud sessions.
To what degree is overall instructional design experience a factor alongside production knowledge on the design decision making and instructional strategy selection for a particular instructional design?	Intake questionnaire – Expertise questions (Chi); self-report yrs. of exp. Thematic analysis of design aloud sess. Follow-on Interviews (Triangulation)	Separate expert and non-expert groups, does rate of confirmed influence differ between the two groups.
To what degree is the instructional designers' employer influencing media selection, design decision-making and instructional strategy selection?	Design aloud sessions Follow-on Interviews (Triangulation)	Thematic Analysis of Design aloud sessions and confirmation in follow-on interviews uncovers the rate of occurrence of influence.

CHAPTER III

RESULTS

This chapter presents the results of the multimedia competencies instrument, the design aloud sessions, follow-on interviews and subsequent thematic analyses. Following an overview of the participants, results are presented according to each of the research questions. Data gathering for the present study took place over the course of two months.

Participants

In total, 30 participants ($n=30$) completed both the multimedia production competency instrument and the design aloud session. Participants were required to be practicing instructional designers with practical experience, though no particular degree, academic or professional credential was mandated as a qualifier to participation.

The participants were asked to report on the number of years of experience possessed within the field of instructional design or human performance technology. The reported years of experience ranged from a low of 1 year of experience to a high of 38 years of experience within the field. More than half of the participants were within the first decade of experience in their careers. An overview of the years of experience is provided in Table 2, grouped by decade of experience.

Table 2

Number of Years of Experience in Instructional Design for All Participants

<u>Years of Experience in Instructional Design</u>	
0-4 years	9
5-10 years	9
11-20 years	8
21-30 years	2
31-38 years	2

Additionally, the participants were asked to provide information about the highest degree each had attained. The provided results were exclusively concentrated on the Master's degree and the Doctoral degree as no participants reported possessing only the high school or associates diploma, nor did any participant claim to possess no degree whatsoever. There were 19 Masters degrees claimed by the participant pool, along with 11 doctoral degrees (Table 3).

Table 3

Highest Level of Education Reported by Participants

Highest Level of Education	
High School	0
Associates	0
Undergraduate	0
Masters/Professional	19
PhD	11
None	0

Participants were only required to be active instructional designers or human performance technologists, and there was no restriction placed on the field of study from prior academic degrees. Nonetheless, the participants were queried about the field of study for the latest and highest degree attained with a majority (20) claiming an academic affiliation to instructional design or instructional technology (Table 4). The balance of respondents (10) provided information about degrees in allied fields to instructional design (education, computer applications or educational leadership), though three participants arrived in instructional design practice from the fields of theology, project management and business administration.

Table 4

Degree Concentrations Associated with the Highest Level of Education Reported by All Participants

Degree Concentration	
Business Administration	1
Computer Applications	1
Education	3
Educational Leadership	4

Instructional Design/Technology	11
Instructional Technology	9
Project Management	1
Theology	1

The participants were also asked to comment on the industry in which they practiced instructional design or human performance technology (Table 5). For this data, participants were permitted to select more than one industry, and 9 “hybrid” participants availed themselves of that option by selection two or more industries of employment. The vast majority of the participants (22) indicated an affiliation with the higher education industry, likely as a result of soliciting participation from AECT (a substantial professional society for those practicing or teaching instructional design and technology at the higher education level). Overall, no industry was left without representation among the sample population.

Table 5

Fields of Current Employment Reported by Participants

Fields of Employment	
Commercial/Corporate	8
Government	5
Higher Education	22
Self-Employed	2
Manufacturing	2
Non-Profit	2
K-12 Education	1
Hybrid	9

Participants were also asked to comment on their level of employment (Table 6). The largest number of participants (13) indicated that their level of employment was that of a non-supervisory worker, meaning these individuals had no oversight of other instructional designers and no budgetary control for their respective employers. The next largest grouping of participants (12) indicated a managerial level of employment status. As with the industry of employment data, participants were permitted to select more than one status, though this

incidentally occurred only in one area: faculty. Only 2 members of the study participant pool indicated more than one employment status. In both cases, the participant was a faculty member and a supervisor.

Table 6

Employment Status within Current Fields Reported by All Participants

Employment Status	
Non-Supervisory Worker	13
Management/Supervisor	12
College/University Faculty	6
Executive	3
Student	1
Hybrid	2

The participants were also asked to self-identify on level of instructional design expertise on a scale developed from Ericsson et al. (1993) and Chi et al. (2014). The data from this scale was compared against their years of instructional design expertise using the standards from Rowland (1992), and an assignment to either an expert or novice group was made. This assignment was reviewed and confirmed by the second reviewer for this study (Table 7). As such, 22 of the participants in the study population were assigned to the experts group due to claimed expertise in the field on the provided scale, greater than 4 years of experience in the field and the affirmation of the researchers in this study.

Table 7

Expert Status of Participants as Defined by Standards from Ericsson et al. (1993), and Chi et al. (2014)

Expert Status Grouping	
Expert	22
Novice	8

Multimedia Production Competencies

Each participant was provided with a list of multimedia production competencies derived from the instructional design production competency research from Sugar, Brown, et al. (2011), Sugar, Hoard, et al. (2011) and Ritzhaupt and Martin (2014). The participant was first asked if they possessed any knowledge on each production skill. If the participant did have the knowledge, they were asked to rate their skill level on a scale between 1 (novice) and 5 (expert). Additionally, participants were asked to rate how influential the skill was on their instructional design decision making (Table 9). The production skills in which participants indicated a skill level of 3 or better on the 5-point scale is provided in Table 8. The production skills in which the participant indicated an influence level of 3 or better on the 5-point scale is provided in Table 9.

Table 8

Top Development Skills as Identified by All Participants, Novice Participants, and Expert Participants

Top Development Skills	All Participants	Novice Participants	Expert Participants
3D Design	3	0	3
3D Printing	0	0	0
Accessibility	3	1	2
Animation	6	1	5
Audio Editing	18	5	12
CMS	8	2	6
Cognitive load on media design	1	0	1
Communication	2	1	1
Computer Hardware	19	4	15
Create course Content Summaries	1	1	0
Databases	12	4	8
Desktop Publishing	14	2	12
E-learning	5	0	5
Emotional Intelligence	1	0	1
Game Development	2	0	2
Google Drive	1	1	0
IDE	3	1	2
Image Editing	20	5	15
Integrated Systems	1	0	1
LMS	26	6	20

Online Quizzes	20	5	15
Online Surveys	17	3	16
Photography	12	2	10
Process Mapping	1	0	1
Programming	3	1	2
Project Management	12	1	11
Root Cause Analysis	1	0	1
Screen Recording	24	7	17
Scripting	4	1	3
Servers	3	1	2
SME Management	1	0	1
Spreadsheets	28	7	21
Strategic Planning	1	0	1
Vector Design	5	0	5
Video Editing	17	5	12
Videography	13	2	11
Web Authoring	16	5	11
Web Blogs	11	2	9
Web Markup	9	2	7
Word Processing	30	8	22

Table 9

Most Influential Development Skills on Design as Reported by All Participants, Novice Participants, and Expert Participants

Skills	All Participants	Novice Participants	Expert Participants
3D Design	0	0	0
3D Printing	0	0	0
Accessibility	4	1	3
Animation	2	0	2
Audio Editing	12	3	9
CMS	5	2	3
Cognitive load on media design	1	0	1
Communication	2	1	1
Computer Hardware	9	2	7
Create course Content Summaries	1	1	0
Databases	6	1	5
Desktop Publishing	9	1	8
E-learning	5	0	5
Emotional Intelligence	1	0	1
Game Development	1	0	1
Google Drive	1	1	0
IDE	1	1	0
Image Editing	16	3	13
Integrated Systems	0	0	0

LMS	22	6	16
Online Quizzes	11	4	6
Online Surveys	9	1	8
Photography	6	0	6
Process Mapping	1	0	1
Programming	1	1	0
Project Management	11	0	11
Root Cause Analysis	1	0	1
Screen Recording	20	5	15
Scripting	3	1	2
Servers	2	2	0
SME Management	1	0	1
Spreadsheets	17	3	14
Strategic Planning	1	0	1
Vector Design	4	0	4
Video Editing	17	4	13
Videography	11	2	9
Web Authoring	11	1	10
Web Blogs	5	2	3
Web Markup	9	2	7
Word Processing	27	7	20
Writing Objectives	1	1	0

Design Aloud Data

Each of the 30 study participants was invited to engage in a design aloud protocol conducted over Skype. For each session, each participant was emailed a scenario document ahead of time with the explicit instruction that each participant not open the document until prompted during the design aloud session. Sessions were recorded, and subsequently coded by the study's primary investigator for incidents of analysis, design, development, implementation and evaluation activity, with a particular attention made to the various modes of front-end analysis, media selection and production skills / authoring tools mentioned during the design aloud session. All codes were reviewed and confirmed by a second reviewer.

Research Question 1: Influence of Development Knowledge on Analysis Findings or Overall Design Decision-making

The overall instructional design behaviors exhibited by the participants during the design aloud sessions were tracked and coded with special attention paid to the type and point of appearance of analysis activity. The goal was not just to quantify and monitor which instructional design behaviors were present in the design aloud sessions, but to also determine at what point and to what extent analysis activity was occurring during the instructional design workflow, and whether the instructional designers were committing to certain platforms or multimedia platforms without analysis data to confirm the decisions.

Ultimately, the design aloud session data analysis uncovered 13 instances in which the instructional design participants proceeded into media selection and design prior to analysis. Of the 13 instances, 5 occurred among the novice group (63%) and 8 instances occurred among the expert group (36%). It should be noted, however, that all 8 novices and 19 experts conducted analysis activity at some point during the design aloud sessions, just not prior to design or media selection activity.

Table 10

Incidence of Behaviors During Design-Aloud Protocol for All Participants, Novice participants, and Expert Participants

	All Participants	Novice Participants	Expert Participants
Design Decisions Before Analysis	13	5	8
Discusses Analysis	27	8	19
Discusses Design	30	8	22
Discusses Implementation	20	4	16
Discusses Evaluation	17	4	13
Discusses Learner Assessment	18	4	14

The rationale for adopting the media-first approach was often related to budget and time constraints, such as is represented by the following quotes:

- “[My decision-making is] defined by budget and time, obviously. If you don't have 3 weeks to create a video, you're not going to be creating a video. You'll do something that takes less time to produce.”
- “I would say budget is a huge issue when it comes to design. That's why I was going paper-based.”

In other circumstances, the media-selection first approach proceeded without analysis on the basis of assumptions about the primary audience for the training. In the following quote, it should be noted that the design scenario did not suggest the workers were technically inclined, but the participant used her experience and prior knowledge to make a media-selection on the basis of a generality, not on any suggested analysis activity:

“The Millennials and especially the Z generation are considered the connected generation. This generation feels more familiar and comfortable with electronic devices than with communications face to face.”

Another participant used the phrase “pragmatic design” to describe the media selection first methodology. He would adopt his media as the first step in the instructional design process, then use a limited analysis phase to look for reasons why the medium should be ruled out. In this way, he claimed to have optimized his instructional design workflow for maximum output as he could essentially use the same tools and media for any number of projects, only adopting alternate approaches to media selection and instructional strategy for situations in which his medium would obviously fail.

Research Question 2: Degree of Development Knowledge Influence on Design Decision-Making

For those participants who provided detail media selection, their choices were coded and are presented in Table 11 along with the top and most influential development skills for each participant. Occasions where there was a relationship between the development skills and the media selection discussed during the design aloud session are also noted in Table 11. It should be noted that among the 13 participants (43%) who adopted media before conducting analysis, all but one listed top or most influential development skills relating to the proposed media. Meaning, among the participants in this study, designers were adopting media without analysis that best fit their self-reported skillset 43% of the time, and almost always adopting media that best conformed to preferred tools and development skills. Novices were most prone to this behavior, though the experts were not immune either.

Table 11

Media Selection and Relevant Production Skills for those Participants Proposing Multimedia Interventions and Relationship to Development Skills

Participant Number	Strongest Development Skills	Most Influential Skills	Media Selected During Design Aloud Protocol	Early Media Selection	Expert Status	Relationship between skills and media
1	Image editing, word processing, video editing, screen recording, web development, LMS, spreadsheets, audio editing, Web CMS, desktop publishing, e-learning software	Image editing, video, screen recording, LMS, e-learning software	Video, In Person	No	Yes	Yes
2	Word processing, Spreadsheets, LMS	Word processing, Spreadsheets,	Games Based Learning, In Person	No	Yes	No
3	Image editing, Word Processing, Video Editing, Screen capture, Web development, LMS, Audio editing, Spreadsheets, Databases, Online Quizzing, Online	Word processing, Screen recording, LMS	In Person, Computer Based Training, Print Guide, Smart Phone App, Video, Animation	Yes	No	Yes
4	Word processing, screen recording, video editing, LCMS, Spreadsheets, Database, audio editing, desktop publishing, section 508, cognitive load on media design, storyboarding, game design principles	Word processing, LCMS, Spreadsheets, section 508, cognitive load on media design, storyboarding, game design principles	Computer Based Training, In Person, Simulation, Animation	Yes	Yes	Yes

5	Image editing, Word processing, Video Editing, Screen Recording, LCMS, Spreadsheets, Databases, Audio editing, Computer hardware, online surveys, online quizzes, photography, videography	Image editing, Word processing, Video Editing, Screen Recording, LCMS, Spreadsheets, Databases, Audio editing, Project management, online quizzes, photography, videography	Video, In Person, Computer Based Training, Animation	No	Yes	Yes
6	Image editing, Word Processing, LMS, Spreadsheets, Databases, Computer hardware, online survey, online quizzes	Word Processing, Spreadsheets, Databases, online surveys	Paper Job Aide, Electronic Checklist	Yes	Yes	Yes
7	Image editing, Word processing, Video editing, screen recording, web authoring, LMS, spreadsheets, audio editing, web content management, web blogs, 3D modeling, game development, IDE, web markup, project management, online survey, online quizzes, photography, videography, animation	Word processing, Video editing, screen recording, web authoring, LMS, spreadsheets, audio editing, web markup, project management, online survey, online quizzes, videography, photography	Games Based Learning, Simulation, Animation, 3D Modeling	Yes	Yes	Yes
8	Word processing, LMS, project management, online quizzes, photography, videography, video production (studio & remote), print media, equipment simulation (real life)	Word processing, LMS, spreadsheet, project management, online quizzes, photography, videography, video production (studio & remote), print media, equipment simulation (real life)	Computer Based Training, In Person, Animation, Checklist	No	Yes	No
9	Image processing, Word processing, Video editing, Screen recording, LMS,	Image processing, Word processing, Video editing,	Computer Based	Yes	Yes	No

	spreadsheets, audio editing, web blogs, web markup, project management, computer hardware, online surveys, videography, e-learning authorware (Articulate)	Screen recording, LMS, web blogs, web markup, e-learning authorware (Articulate)	Training, Simulation			
10	Image editing, Word processing, spreadsheets, project management, online surveys, online quizzes	Image editing, Word processing, video editing, screen recording, web authoring, LMS, spreadsheets, databases, audio editing, desktop publishing, accessibility standards, project management, computer hardware	Environmental Cues, Checklist	No	Yes	No
11	Word Processing, LMS, Spreadsheets, Computer Hardware, Online Quiz, Strategic Planning, Project Management, Communication, Emotional Intelligence	Word Processing, Spreadsheets, Computer Hardware, Strategic Planning, Project Management, Communication, Emotional Intelligence	Computer Based Training, In Person, Checklist,	Yes	Yes	No
12	Word Processing, Screen Recording, Web Authoring, LMS, Spreadsheets, Audio Editing, Web Blog, Accessibility, Computer Hardware, Online Survey, Online Quiz	Image Editing, Word Processing, Video Editing, Web Authoring, LMS, Spreadsheets, Audio Editing, Web CMS, Web Markup, Accessibility, Computer Hardware, Online Survey, Online Quiz	Photography, Video, Computer Based Training, Environmental Cues, Checklist	No	Yes	Yes

13	Word Processing, Screen Recording, LMS, Spreadsheet, Computer Hardware, Online Survey, Online Quiz	Screen Recording, LMS, Spreadsheets, Computer Hardware, Online Survey, Online Quiz	Computer Based Training, In Person	No	Yes	Yes
14	Image Editing, Word Processing, Vector Graphics, Video Editing, Screen Recording, Web Authoring, LMS, Spreadsheets, Database, Audio Editing, Desktop Publishing, CMS, Web Blog, Scripting, Programming, IDE, Web Markup, Project Management, Computer Hardware, Integrated Systems, Online Survey, Online Quiz, Photography, Videography, Animation	Word Processing, Vector Graphics, Video Editing, Screen Recording, Web Authoring, LMS, Audio Editing, Web Markup, Project Management, Computer Hardware, Online Survey, Videography	Checklist, In Person	No	Yes	
15	Image Editing, Word Processing, Vector Graphics, Video Editing, Screen Recording, Web Authoring, LMS, Spreadsheets, Database, Audio Editing, Desktop Publishing, CMS, Web Blog, Programming, Web Markup, Project Management, Computer Hardware, Online Survey, Online Quiz, Photography, Videography, Animation, Storyboarding	Image Editing, Word Processing, LMS, Spreadsheets, Desktop Publishing, Web Markup, Online Survey, Photography, Videography, Storyboarding	In Person, PowerPoint	No	Yes	Yes
16	Image Editing, Word Processing, Vector Graphics, Screen Recording, LMS, Spreadsheets, Audio Editing, Desktop Publishing, Web Blog, Project Management, Computer Hardware, Online Survey, Online Quiz, Photography, Videography, SME Management, Learning Authoring	Image Editing, Word Processing, Vector Graphics, Screen Recording, LMS, Audio Editing, Project Management, Computer Hardware, SME Management, Learning Authoring Software,	Games Based Learning, In Person, Electronic Checklist, PowerPoint, Video	No	Yes	Yes

	Software, Narration Scripting, Power Point	Narration Scripting, Power Point				
17	Word Processing, Screen Recording, Web Authoring, LMS, Spreadsheet, Database, Audio Editing, Project Management, Computer Hardware, Online Survey, Online Quiz	Word Processing, Screen Recording, LMS, Spreadsheet, Audio Editing, Online Quiz	Computer Based Training, Map, Environmental Cues	No	No	No
18	Image Editing, Word Processing, Video Editing, Screen Recording, Web Authoring, LMS, Spreadsheets, Database, Online Survey, Online Quiz, SharePoint/Web Design	Image Editing, Word Processing, Video Editing, Screen Recording, Web Authoring, Spreadsheets, Online Survey, SharePoint/Web Design	Computer Based Training, Environmental Cues, Checklist	Yes	Yes	Yes
19	Image Editing, Word Processing, Vector Graphics, Video Editing, Screen Recording, Web Authoring, LMS, Spreadsheets, Database, Audio Editing, Desktop Publishing, CMS, Web Blog, 3D Modeling, Scripting, Web Markup, Computer Hardware, Photography, Videography, Animation, Presentation Software, Narrated Slideshow Software	Image Editing, Word Processing, Vector Graphics, Video Editing, Screen Recording, Web Authoring, LMS, Database, Audio Editing, Desktop Publishing, CMS, Web Blog, Scripting, Web Markup, Photography, Videography, Animation, Presentation Software, Narrated Slideshow Software	Video, Photography, In Person,	Yes	Yes	Yes
20	Image Editing, Word Processing, Screen Recording, Web Authoring, LMS, Spreadsheets, Audio Editing, Web Markup, Project Management,	Image Editing, Word Processing, Screen Recording, Web Authoring, LMS,	In Person, Environmental Cues, Checklist	No	Yes	No

	Computer Hardware, Online Survey, Online Quiz	Spreadsheets, Project Management, Computer Hardware				
21	Word Processing, Screen Recording, Web Authoring, LMS, Spreadsheets, Audio Editing, Desktop Publishing, Web Blog, Web Markup, Project Management, Computer Hardware, Online Survey, Online Quiz, Articulate Storyline 2, Articulate Studio	Word Processing, Screen Recording, Web Authoring, LMS, Spreadsheets, Audio Editing, Project Management, Online Survey, Online Quiz, Articulate Storyline 2, Articulate Studio	Computer Based Training, Games Based Learning	Yes	Yes	Yes
22	Image Editing, Word Processing, Vector Graphics, Video Editing, Screen Recording, Web Authoring, LMS, Spreadsheets, Database, Audio Editing, Desktop Publishing, CMS, Web Blog, 3D Modeling, Scripting, Web Markup, Computer Hardware, Photography, Videography, Animation, Servers, Project Management	Image Editing, Word Processing, Vector Graphics, Video Editing, Screen Recording, Web Authoring, LMS, Database, Audio Editing, Desktop Publishing, CMS, Web Blog, Scripting, Web Markup, Photography, Videography, Animation	Environmental Cues (Electronic Timer and Automated Temperature Check), Checklist	No	Yes	Yes
23	Image Editing, Word Processing, Screen Recording, Spreadsheets, Online Survey, Online Quiz, Photography, Graphic Design, Project Management	Word Processing, Screen Recording, Online Quiz, Graphic Design, Project Management	N/A	No	Yes	N/A
24	Image Editing, Word Processing, Video Editing, Screen Recording, Web Authoring, LMS, Spreadsheets, Database, Audio Editing, CMS, Web Blog, Web Markup, Computer Hardware, Online Quiz, Photography,	Image Editing, Word Processing, Video Editing, Screen Recording, LMS, Audio Editing, CMS, Web Blog, Web Markup, Online	In Person, Videos	Yes	No	Yes

	Videography, Animation, Communication Skills, Empathy	Quiz, Videography, Communication Skills, Empathy				
25	Word Processing, Screen Recording, Web Authoring, Spreadsheets, Database, CMS, Scripting, Video Editing, Programming, IDE, Web Markup, Servers, Computer Hardware	Web Authoring, Spreadsheets, Database, CMS, Scripting, Programming, IDE, Web Markup, Video Editing, Servers, Computer Hardware	Video, In Person	Yes	No	Yes
26	Word Processing, Screen Recording, LMS, Spreadsheets, Servers, Computer Hardware, Online Quiz, Creating Course Content Summaries, Writing Objectives	Word Processing, LMS, Servers, Online Quiz, Creating Course Content Summaries, Writing Objectives	Computer Based Training	Yes	No	Yes
27	Image Editing, Word Processing, Video Editing, Screen Recording, Web Authoring, LMS, Spreadsheets, Audio Editing, Desktop Publishing, Web Blog, Accessibility, Computer Hardware, Online Survey, Online Quiz, Google Drive	Image Editing, Word Processing, Video Editing, Screen Recording, LMS, Spreadsheets, Web Blog, Accessibility, Computer Hardware, Online Survey, Online Quiz, Google Drive	Computer Based Training, Checklist	No	No	Yes
28	Image Editing, Word Processing, Screen Recording, LMS, Spreadsheets, Computer Hardware, Photography, Process Mapping, Root Cause Analysis	Image Editing, Word Processing, Screen Recording, Spreadsheets, Computer Hardware, Videography, Process Mapping, Root Cause Analysis	In Person	No	Yes	No
29	Word Processing, Spreadsheets	Word Processing	Video, Computer	Yes	No	No

			Based Training, Checklist, Automation (Computer Alarm)			
30	Image Editing, Word Processing, Video Editing, Screen Recording, LMS, Audio Editing, Photography, Videography, PowerPoint	Image Editing, Word Processing, Video Editing, Screen Recording, LMS, Audio Editing, Videography, PowerPoint	Video, Checklist, Environmental Cues	No	No	Yes

Research Question 3: Experience of the Instructional Designer as a Factor on Design

Decision Making

Ideally, design decision making during the instructional design workflow can be associated back to data gathered during analysis. The design aloud sessions were coded not only for the presence of analysis activity, but the variety of analysis tasks proposed for the scenario. The frequency of occurrence for each type of analysis was compiled from the participant pool. The frequency of type of analysis is presented in Table 12, and is reported not only in aggregate for all participants, but also along the novice and expert groupings established previously. Behavioral task analysis was the most common activity, and was proposed by 18 participants. Cognitive task analysis was the second most common activity, and was proposed by 15 participants. Overall, the novice participants tended to propose fewer types of analysis activity per session (an average of 3.6 analysis activities per session), whereas the experts proposed a much more thorough analysis approach (an average of 4.5 analysis activities per session).

Table 12

Analysis Behaviors Present in Design Aloud Protocol for All Participants, Novice Participants, and Expert Participants

Analysis Behavior	All Participants	% of All	Novices	% of Novices	Experts	% of Experts
Behavioral Task	18	60%	6	75%	12	55%
Cognitive Task	15	50%	4	50%	11	50%
Content	8	27%	1	13%	7	32%
Contextual	1	3%	0	0%	1	5%
Environmental	6	20%	1	13%	5	23%
Goal	3	10%	0	0%	3	14%
HPT Orientation	6	20%	2	25%	4	18%
Knowledge Gap	3	10%	0	0%	3	14%
Learner Analysis	10	33%	3	38%	7	32%
Cost Benefit	1	3%	0	0%	1	5%
Motivational	1	3%	0	0%	1	5%
Needs Assessment	6	20%	0	0%	6	27%

Objectives	10	33%	3	38%	7	32%
Performance	8	27%	4	50%	4	18%
Resource	6	20%	1	13%	5	23%
Root Cause	2	7%	0	0%	2	9%
Sequencing	1	3%	0	0%	1	5%
SME Consultation	10	33%	1	13%	9	41%
Unstated Goals	2	7%	0	0%	2	9%

In terms of the success with which experts had in suggesting analysis activities, one of the more experienced participants made the following remark in reference to pushback on analysis activities from clients or employers:

“At the end of the day, it’s an interesting thing that as I’ve gotten older, I’ve gotten less diplomatic, but I’ve also become less dogmatic about [analysis]. When I’m in that situation, once I stop being upset, I explain what the trade-off is going to be.”

She went on to say that over the years of her career, she has come to recognize the power and value of analysis to drive design decision-making. She offered the following statement:

“I have several points that I make with all of my clients and also with my staff, which is that the technology is not the solution, it is the tool and we’re much better off remaining flexible to use the tool based on what the problem statement is.”

In contrast, the novice seemed less aware of the range of analysis activity possible, and proceeded into design most frequently with data only from behavioral and cognitive task analyses, which correlates with the expectation of a deeper analysis with the expert in Chi et al. (2014).

Research Question 4: Employer Influence on Media Selection and Instructional Design Decision-Making

During the design aloud scenario, participants were also asked about the extent to which employers were influencing analysis-based activities as the basis for conducting media-selection

and design decision-making. Employers were defined as the parties with management or supervisory roles over the instructional designer. This line of questioning during the design aloud sessions produced data concerning how many participants feel pressure to limit or eliminate analysis activities, or select certain employer-preferred media for instructional interventions. Among all the participants, 20 instructional designers (67%) felt pressure to eliminate analysis activities from their workplace environments, and 16 participants (53%) had workplace policies or workflow structures that did limit the extent to which analysis activity could be conducted. In terms of media selection, 17 participants (57%) felt pressures from an employer to use a particular medium or development skill.

Table 13

Participant Reporting of Employer Influence on Design Process from All Participants, Novice Participants, and Expert Participants

	All Participants	Novice Participants	Expert Participants
Employer Limits Analysis	16	5	11
Employer Limits Media	17	5	12
Designer Feels Pressure from Employer to Eliminate Analysis	20	5	15

An experienced instructional designer commented on the deeper benefits to front-end analysis on decision-making and relayed that employers often *do* press for solutions first. According to this participant though, his employers often do appreciate guidance from the instructional designer to adopt a systematic approach to intervention design, beginning with an analysis stage:

“Honestly, most of the time when I've asked them to step back and think about [analysis], it usually leads to them saying, ‘Well, no. We hadn't considered that. Let's step back. Maybe we were being rash.’ ... By saying, ‘Have you considered.’ Sometimes that may make you feel uncomfortable, but I've found, usually you're better doing that than just jumping on the direction that you're given and not looking back. Almost always, those are

solutions that have not been well thought out.”

In this way, this participant is able to redirect the employer expectations for an immediate intervention design and implementation in favor of analysis. The implication is that the employer does not know about or understand the potential impact of analysis, and relies on the experienced instructional designer to make the case for such a step.

Among the participants, another means of employer structuring of analysis stands out. In this particular situation, a participant commented that his employer assigned instructional design analysis activities to a stakeholder committee:

“A lot of the analysis doesn't fall on me solely. The way we do things at the college is we form committees. These committees will conduct a lot of the analysis. I'm not always on the committee ... I would rather do [the analysis] but in the structure of the place that I work at, it's really heavily committee driven. Whatever [the committee] decides, is pretty much what you go with.”

In this manner, the employer is controlling and limiting analysis activities to a stakeholder committee. When asked if the members of this committee were qualified for such a responsibility, the participant responded that he would prefer to do the work himself, and was concerned that his analysis committee of college faculty were not trained to perform the tasks assigned.

In terms of limiting analysis activity, other participants reported employer pressures and influences on analysis:

- *“I'm pretty constrained as to what I can do. I try to finagle some [analysis] things in there, but those other decisions are made for me.”*
- *“It's so time consuming and my job is so big. It's the nature of my job. That's a very detailed, tedious, time-consuming process. I have three hundred instructors that rely on me for their online presence. They're more worried about, 'How do I lock my syllabus quiz? How do I get our FTEs? My grade book doesn't look right. How can I check my grades? Some student isn't seeing their grade. What setting is wrong?' I'm*

so busy with all of that type of work.”

- *“I don't think anyone above me even really understands anything about front end analysis, or any of that.”*
- *“I would say from a needs analysis point of view, I feel like [the employers] think they know what they know, so they kind of skip over [analysis].”*

Overall, the majority of participants (66%) felt employer pressures to reduce or eliminate analysis activities, and 17 (56%) worked in environments where analysis was either de-facto eliminated by budget or resource restrictions, or by employer policy.

CHAPTER IV

DISCUSSION

The purpose of this study was to examine the extent to which development knowledge, experience and employers are influencing instructional design decision-making. Overall, findings suggest that the analysis phase of the instructional design workflow is being influenced both by employers, by experience and by development knowledge.

As predicted by the body of research into instructional design workflow (Gray et al., 2015; Kenny et al., 2005; Kirschner et al., 2002; Wedman & Tessmer, 1993; York & Ertmer, 2011), the present study uncovered evidence that instructional designers are adapting and modifying instructional design models into practical workflows. The practical workflow used by almost all participants in this study was iterative in which the instructional designers returned to the various stages of an *ADDIE-esque* workflow multiple times. The iterative behavior seen in this study is similar to that which Rowland (1992) described as “zig-zags”. In theory, this iterative approach to instructional design permits the designer to act fluidly, perhaps even pulling in new analysis techniques or design approaches as later project findings might require. In this manner, instructional designers are refining and customizing interventions to best suit project needs as new details arise, possibly via new analysis findings.

Influence of Production Knowledge Design Decision-Making

The standards for expertise from Chi et al. (2014) predict that experts will exhibit a more thorough analysis of any given problem within their domain. The behaviors of the experts in this study match that prediction. As reported, the novice participants from this study tended to propose fewer types of analysis activity per session (an average of 3.6 analysis activities per session), whereas the experts proposed a much more thorough analysis approach (an average of

4.5 analysis activities per session). The variety of analysis activities also differed between the novices to experts, which also conforms to the standards of expertise from Chi et al. As a result, expert instructional designers may be producing more accurate findings from an analysis phase, not just due to the increased number of analysis activities performs but also by the variety. In contrast, novice instructional designers may be missing opportunities for the use of alternate media or instructional strategies.

In the present study, one particular trend stood out from even the variance in depth of analysis between experts and novices. Certain instructional designers were adopting media as an initial step in their instructional design workflow and, if they used analysis at all, analysis was used only at a cursory level to rule out the early media selection. Both expert and novice instructional designers exhibited this media-first behavior, though the novices did so at greater rates. Chi et al. predict that experts exhibit a propensity to deeper analysis activity during problem-solving. So, it may be that the lowered rate of media-first behavior among experts could be attributed to a raised awareness of analysis among experts. The media-first behavior certainly was not curtailed completely by expertise though, making this a systemic problem among both novice and expert participants.

Eventually, almost all participants conducted some form of an analysis. In the cases in which media was selected first, analysis was done to validate media choice. This approach runs counter to the approach present in many instructional design models, wherein analysis *informs* media selection and the design phase of the instructional design workflow. So while research might suggest adjustments to instructional design workflow (Gray et al., 2015; Kenny et al., 2005; Kirschner et al., 2002; Wedman & Tessmer, 1993; York & Ertmer, 2011), the present

study expands on this research by providing evidence that designers are frequently repurposing analysis as a confirmation stage for media-first design.

Degree of Development Knowledge Influence on Design Decision-Making

As has already been discussed, a surprising proportion (43%) of the participant pool adopted media prior to conducting analysis. Among the participants making media selections first, almost all were using the tools and development skills they reported as their strongest or most influential. As shown in Table 11, however, the bias was present even among those participants who did perform an appropriate degree of analysis. So, it would seem that instructional designers are tending to adopt media that are most comfortable, even when performing a front-end analysis. In consideration of the spectrum of solutions suggested, the variety is in line with other multimedia production competency research (Ritzhaupt et al., 2010; Sugar, Brown, et al., 2011; Sugar, Hoard, et al., 2011). The participants in this study presented with roughly the same arrangement of skills that would have been expected, given the prior research. The new finding in the present study is the extent to which those same design skills are apparently influencing the design decision-making of instructional designers, as the present study does uncover evidence that designers are favoring preferred tools and media. This bias is more than just *good enough* design, whether the instructional designer is producing the end product to save costs over specialist developers. Rather, the data from the present study suggests that designers are not almost considering a full range of media options and are instead defaulting to a select bouquet of media based on, at best, insight into what may have worked well previously in similar situations.

Experience of the Instructional Designer as a Factor on Design Decision Making

In the present study, expertise was a mitigating factor in some of the unexpected workflow behaviors (such as the media-first or elimination of analysis). Expertise was not a panacea however, as experts did still adopt media without initial analysis backing. As predicted by the research from Visscher-Voerman and Gustafson (2004), the experts were aware of how their workflow approaches deviated from the norms anticipated from instructional design models, particularly when media selection occurred as a preliminary stage. The participants were quick to rationalize the variations – even the media-first approaches – on the basis of experience, and limited resources. Rowland (1992) discusses the use of expert “schematics” for design, which are those expert adaptations to the instructional design workflow, and the branching decision-making trees that allow experts to bring prior experience to bear on current projects. The present study can expand on the “schematics” concept somewhat by providing some evidence that instructional designers are also using prior experience and any resulting assumptions about audience and instructional goals to short-circuit the decision-making trees apparently in favor of media and development skills that best suit the designers.

Employer Influence on Media Selection and Instructional Design Decision-Making

In terms of the pressures instructional designers feel to reduce or eliminate analysis as a stage of the instructional design process, the results of this study fall in line with those from Hoard and Stefaniak (2016) and Wedman and Tessmer (1993). Instructional designers are quite often being asked or forced to limit analysis activities during the instructional design process. In the present study, many of the instructional designers adopted an almost fatalistic approach to analysis in that they conceded analysis to the orders of their employers. In at least one case, analysis had even been taken from the capable hands of an instructional designer and assigned to a stakeholder committee instead, the membership of which may or may not have been qualified

to perform such a process. As has already reported, some designers (43%) even waited to conduct analysis until after selecting for a media for the final intervention. In many cases, there appeared to be an acceptance of this reality – that analysis was not a make-or-break phase during the instructional design process, and that design work could continue and succeed even without analysis data. Instead, designers seemed content – and accustomed to – moving ahead with limited analysis data, or assumptions based on prior interactions with classes of learners. In some ways, this behavior of limited or reduced analysis fits within the findings of Christensen and Osguthorpe (2004) and Visscher-Voerman and Gustafson (2004), who suggested that instructional designers may be tending to outsource many micro-level design decisions to project stakeholders like management. Designers within the present study even reported on accepting analysis data as-told-by employers. In these circumstances, it would appear that designers are approaching intervention design from the angle of rapid prototyping, which Roytek (2010) suggested as a measure to improve instructional design efficiency. The behavior makes sense as the same workplace resource constraints that are limiting analysis activities are likely also limiting the time to design. The effect is that instructional designers are feeling a pressure to leap directly into design without a full analysis phase, just as the participants in this study report is often the case.

Implications

The most obvious implication of the present study is to confirm that analysis is often being skipped or limited in the instructional design workflow, as has been reported in other published research (Hoard & Stefaniak, 2016; Wedman & Tessmer, 1993). In the present study, the experts and novices both reportedly recognized the importance of analysis as a stage in the instructional design process, though often navigating employer demands or practical workload

matters precluded a satisfactory level of analysis activity. Certain instructional designers are finding ways around such limiting factors by failing to label analysis activity as such, or adopting the least time and resource consumptive approaches to analysis. Moreover, it appears analysis activity is still happening, though perhaps not at the stage of the instructional design workflow that might be suggested by formal models. In these circumstances, analysis is potentially being used to justify early media adoptions.

Given that media adoptions are occurring so early in the instructional design process – as a first step in some cases – the driving factor in design decision making appears to be client suggestion or personal preferences of the designer. Education and experience do not appear to fully mitigate this tendency. As such, the field may be best to address the problems with analysis on two fronts: (1) reducing or eliminating employer limitations on analysis and (2) continuing to reinforce the importance of analysis among all instructional designers.

In terms of employer pressures on analysis, it may be helpful to encourage additional research into the project-cost effects of analysis in an attempt to begin quantifying potential cost savings on projects in generalizable ways. The behaviors of the individual designers might be addressed in similar ways. Participants in this study often attributed the elimination of analysis or media-first behaviors to a lack of resources, time being amongst the scarcest. So, it may be helpful to begin framing analysis activities as time saving measures when training designers. That is, analysis activity can be a time saving measure when it prevents or eliminates the need for revisions late in the project workflow.

Limitations

The present study was conducted remotely using a population of well-educated, higher-education focused participants. As such, the results and findings presented herein may be best

understood as a function of the limited scope of the participant pool. Additionally, given the nature of the data gathering technique, direct observation of the participants was impossible, and it is possible that actual workplace behaviors might differ from what the participants presented during the design aloud sessions. The participants were also entirely English-speaking and possessing of educations from North American institutions of higher education. It is possible that actual workplace performance and educational standards for instructional design might vary in other areas of the world, which a larger and more diversified participant population might better reflect. The participant pool was obviously skewed heavily to the well-educated as every participant held an advanced degree with more than half of those degrees coming from instructional design or affiliated fields. As a result, it is possible that the design behaviors recorded in the present study may be skewed to the formal processes taught in formal classrooms, versus the types of instructional design trainings that might be gleaned from informal or on-the-job trainings that could be commonplace for instructional designers who find and enter the field from outside the classroom.

Future Research

In the present study, participation was not intentionally limited to North American instructional designers. Future research might be conducted with a more global distribution of instructional designers in order to determine if the trends and bias around media selection is endemic to North America, or systemic to the field in general. Additionally, future research into the variety of analysis activity used in practice, and the extent to which each type of analysis can on its own or as part of an analysis portfolio mitigate media-first design behaviors may help the field reduce and limit media selection bias. The present research underscored that many instructional designers are experiencing workplace policies or resource constraints that eliminate

or reduce the breadth of analysis that can take place during instructional design. Future research might investigate and enumerate any trends in employer policies concerning analysis limits, or adaptations instructional designers employ to accomplish analysis in resource limited work environments.

Conclusion

Overall, the present study uncovered some surprising trends among the instructional design processes exhibited by the participants, notably a reliance on analysis to validate an early media selection and the extent to which employers are limiting / eliminating analysis within the roles of instructional designers. The findings of this study suggest that the field of instructional design has some work to do in building up and continually fortifying the position of analysis as an *initial step* in the instructional design process, rather than as a measure for validation or cost-cutting eliminations. Additionally, this study developed and presents evidence that instructional designers are adopting media and designs that lean on the designer's strongest and most influential development skills.

Fundamentally, this research study attempts to provide a practical workflow-orientation to the multimedia production competency line of research and, in doing so, uncovered some surprising trends from how and when analysis is being utilized during the instructional design process. In many cases, it appears as though analysis is not being prioritized during the design process compared to technology and media selection. Furthermore, professional development and level of expertise in the field is not sufficient to fully mitigate this effect.

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Appendix A

Instructional Design Production and Development Skills Worksheet

Using the checkboxes to the left, first identify and indicate which of the following production and development skills you possess. Then, for each item you identify, use the provided scale to the degree of proficiency you feel you have with the item, and also how influential you feel the skill is on your daily practice (i.e., how having that skill affects your project planning and workflow).

Proficiency Scale	Influence Scale
1- Novice	1- Not influential at all.
2- Low proficiency	2- Minimally influential.
3- Average	3- Moderately influential.
4- High proficiency	4- Strong influence.
5- Expert	5- Primary influence.

	Skill / Competency	Proficiency	Influence
<input type="checkbox"/>	Image editing (e.g., Adobe Photoshop)		
<input type="checkbox"/>	Word processing software (e.g., Microsoft Word)		
<input type="checkbox"/>	Vector image software (e.g., Adobe Illustrator)		
<input type="checkbox"/>	Video editing (e.g., Adobe Premiere)		
<input type="checkbox"/>	Screen recording software (e.g., Camtasia or Captivate)		
<input type="checkbox"/>	Web authoring tools (e.g., Adobe Dreamweaver)		
<input type="checkbox"/>	Course management systems (e.g., Blackboard or Moodle)		
<input type="checkbox"/>	Spreadsheet software (e.g., Microsoft Excel)		
<input type="checkbox"/>	Database software (e.g., Microsoft Access)		
<input type="checkbox"/>	Audio software (e.g., Audacity)		
<input type="checkbox"/>	Desktop publishing software (e.g., FrameMaker)		
<input type="checkbox"/>	Web content management systems (e.g., Drupal)		
<input type="checkbox"/>	Web blogging software (e.g., Wordpress)		
<input type="checkbox"/>	3-D modeling tools (e.g., Maya)		
<input type="checkbox"/>	Game development frameworks (e.g., Unity)		
<input type="checkbox"/>	Scripting languages (e.g., VBScript or JavaScript)		
<input type="checkbox"/>	Programming languages (e.g., VB, Python or C)		
<input type="checkbox"/>	Integrated development environments (E.g., Visual Studio)		
<input type="checkbox"/>	Web markup languages (e.g., HTML)		
<input type="checkbox"/>	Accessibility software (e.g., JAWS)		
<input type="checkbox"/>	Server environments (e.g., Microsoft Windows Server)		
<input type="checkbox"/>	Project management software (e.g., Microsoft Project)		
<input type="checkbox"/>	Computer hardware		
<input type="checkbox"/>	Integrated systems development (e.g., Raspberry Pi)		
<input type="checkbox"/>	3-D Printing		
<input type="checkbox"/>	Online survey tools (e.g., SurveyMonkey)		
<input type="checkbox"/>	Online quiz / assessment tools		

<input type="checkbox"/>	Photography		
<input type="checkbox"/>	Videography		
<input type="checkbox"/>	Animation (e.g., with Flash, HTML5 or Silverlight)		

In the space provided below, please add any remaining production and development skills that were not covered below, but you feel are important to your instructional design process. Please use the original scales to rate your proficiency on these items and the degree to which you feel they influence your decision-making. Please add new rows, if you need the space.

	Skill / Competency	Proficiency	Influence
<input type="checkbox"/>			
<input type="checkbox"/>			
<input type="checkbox"/>			
<input type="checkbox"/>			
<input type="checkbox"/>			
<input type="checkbox"/>			
<input type="checkbox"/>			
<input type="checkbox"/>			
<input type="checkbox"/>			
<input type="checkbox"/>			
<input type="checkbox"/>			
<input type="checkbox"/>			
<input type="checkbox"/>			

For the following items, please use the associated scale to rate how well the phrase applies to your practice as an instructional designer.

Applicability Scale
1- Strongly Agree
2- Somewhat Agree
3- Neutral
4- Somewhat Disagree
5- Strongly Disagree

Phrase	Rating
I am confident in my practice as an instructional designer.	
I am able to perceive patterns in the problems I solve as an instructional designer.	
I work quicker than novices to the field of instructional design.	
I have a low rate of error with my instructional designs.	
I am able to easily retain details of an instructional problem.	
I am able to perceive instructional problems at a deep level.	
I spend a great deal of time analyzing a problem qualitatively.	
I have strong self-monitoring skills.	

Appendix B

There is no “right” or “wrong” approach to this scenario, so please do not be self-conscious about your approach.

Scenario

You are an instructional designer for Coca-Cola, and you are working with the personnel in the receiving and supply-chain office. This office is responsible for receiving and storing the daily production of Coca-Cola soda, before it is shipped out to market. The product must be stored in a first-in, first-out fashion in that the product that is delivered first during the shift is stored first in a refrigerated storage area. The administration of Coca-Cola has asked that you develop training to assist fresh hires in the receiving office to initially learn their job duties quickly.

Job Description

The employees of the receiving office receive six pallets of 2-liter bottles Coca-Cola at regular 15-minute intervals during the work day. The pallets are delivered by forklift and placed on a receiving dock. The workers transfer the pallets of 2-liter bottles from the receiving dock to cold storage, using a pneumatic dolly. The product must be arranged in cold storage such that the product received first in the shift is toward the front of the storage area and later receipts are to the back. This arrangement allows for the products to be removed by other workers in the same sequence in which they were stored. Each worker must be able to read and monitor the temperature of the cold storage area (every 15 minutes) and adjust a thermostat to maintain 45 degrees Fahrenheit inside of the cold storage area.

Employees work a standard 8:30am to 5:00pm shift, and work on a team of three. Workers receive a 30-minute lunch break. Each worker will move 2 pallets of Coca-Cola product into cold storage per 15-minute delivery cycle.

Needs Assessment

Management has asked that you produce training for new hires in the receiving office so that the job can be done consistently among the new hires. Management reports that turn-over in this role can be somewhat high – on average once every 6-months – due to employees being promoted to other roles within the company, and asks that the training be reusable as new employees are hired.

Learner Analysis

All workers are able to read English at a 7th grade level, possess basic computer technical proficiency, are able-bodied and have high school diplomas. Workers are fresh hires and have not worked for Coca-Cola before, nor have they any similar work experience. Workers are required to be over the age of 18, though the majority of hires are between the ages of 19 and 34. They have a normal range of hearing, and are generally well-motivated to learn and perform the duties of their job. (Receiving office employees understand that performing well in their current role generally leads to promotion to other areas of Coca-Cola within 6-months of hire).

Environmental Analysis

You have access to Coca-Cola's training lab, which includes a classroom set of Windows computer systems and the corporate Intranet. An outside Internet connection is not available in this training facility. The facility is well-lit, quiet and contains enough seating and computer terminals for all the trainees. There is an instructor station equipped with an overhead projector and computer terminal. A traditional "overhead transparency" project is also available in the room, along with a white board and markers. There are also standard tables and chairs with enough seating for all trainees, and enough open floor space for demonstrations.

Additionally, the workers will all be given the first hour of every work day (Monday through Friday) to interact with any training interventions that you create.

Learning Objectives

Upon completion of training:

- 1) The workers will need to know where to retrieve the Coca-Cola products.
- 2) The workers will know where to store the Coca-Cola products.
- 3) The workers will use the pneumatic dolly to move the product into cold storage.
- 4) The workers will store the products using a first-in, first-out strategy.
- 5) The workers will monitor the temperature of the cold-storage area every 15-minutes.
- 6) The workers will adjust a thermostat to adjust the cold-storage temperature to 45 degrees Fahrenheit.

Cognitive Task Analysis

Novice

<ul style="list-style-type: none"> The inflow of product is daunting, and I feel like I am falling behind pace. Since I feel rushed, I feel like I might be storing products in the wrong order. 	<ul style="list-style-type: none"> By the end of my shift, I'm tired so I forget what row I'm on when I'm storing product. Sometimes I forget to check temps.
--	---

Expert

<ul style="list-style-type: none"> Common to be distracted by flow of deliveries and miss temperature monitoring. Sometimes the dolly needs a shove to get moving. 	<ul style="list-style-type: none"> The rows in the refrigerated storage area are numbered, so keeping things in the right order is a matter of remembering which row you are on. Only 1 person needs to check the temps, but we all check in case someone forgets.
--	--

For the next 30-minutes, please outline and explain your approach to this instructional design scenario. Describe and broadcast your thought process and reasoning to the researcher who will be observing this session. The researcher is most interested in your process, and *why* you are determining to work in the pattern that you ultimately adopt.

Curriculum Vitae

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Education

Instructional Design & Technology (Doctor of Philosophy)

Exp. Dec 2016

Old Dominion University, School of Education (3.96 GPA)

Admitted to Doctoral Candidacy, April 2016

Instructional Technology (Masters of Science)

July 2011

East Carolina University, School of Education (4.0 GPA)

Initiated into Phi Kappa Phi; Omicron Delta Kappa

Technical Communication (Bachelors of Science)

December 2003

Mercer University (Macon, Georgia), School of Engineering

Professional Experience

Director of Web Services

(2004 - Present)

Randolph-Macon

College

- Routinely consulted with administration, college committees and individual faculty to advocate for and lead in the strategic acquisition of technology in support of campus learners, the overall educational goals of the institution, along with alumni and development missions of the College.
- Determined evolving technology needs, and integrated appropriate emerging technologies, particularly web, mobile and social media into instructional, recruitment and campus communication efforts.
- Identified skill gaps, then developed and deployed technical training and curriculum for all institutional web content managers on various web content management systems, content and overall web communications best practices.
- Provided ongoing customer service, technical support, training resources, job aids, JITT resources and instructor-led classroom-based training sessions to web content managers and college faculty.
- Directly performed design and development tasks using the Microsoft .NET stack of development technologies and servers, including upgrades, maintenance and customization of various web-enabled systems.

- Coordinated, trained and evaluated production efforts of a diverse group of content managers in various college departments and offices.
- Managed daily operations and individual professional development / evaluation of a college staff of web designers, developers and part-time student employees.
- Project managed and directed numerous enterprise-scale technology assessment, acquisition and implementation efforts, including explicit needs assessment, requirements gathering, enterprise systems selection, implementation, deployment, user testing, information architecture realignment, content porting and all technical training efforts.
- Engineered and executed a successful web content audit and needs assessment to refine and realign content items on the college's public web site and Intranet, leading to a major (>97%) reduction in maintenance overhead.
- Responsible for proposal writing, bid management and vendor selection process for all technology and web projects relating to college communications.
- Directly contributed to and lead interactive media production, especially in areas of video and audio production.

Academic Research & Speaking Engagements

“Qualitative Analysis of the Human Performance Technology Practitioner Standards from ISPI and the Degree of Standard Acceptance by the Field”; Hoard and Stefaniak; Old Dominion University; 2016

“Comparison and Analysis of Existing Multimedia Production Competencies Studies: Implications and Next Steps.” Sugar, Brown, Daniels, Hoard, Martin and Fitzhaupt; Association for Educational Communications and Technology, Annual Conference; 2014.

“Educational Technology Professionals in Higher Education: Multimedia Production Competencies Identified from a Delphi Study.” Daniels, Sugar, Brown and Hoard; Society for Information Technology & Teacher Education International Conference; 2012.

“Instructional Design and Technology Graduates’ Multimedia Competencies: A Delphi Study” Sugar, Brown, Hoard and Daniels; 2010.

“Affective Instruction in Social Media: Volunteer Recruitment & Community Engagement”; Hoard; Hanover County Dept. of Volunteers Quarterly Meeting; 2010.

“Intersections of Tech. Comm. & Instructional Design: ADDIE as a Generic Model of Content Development”; Hoard; James River STC Chapter, Regional Conference; 2010.

“Collaboration in the Cloud: Effective Leveraging of Social Media in Office Teams”;
Hoard; James River STC Chapter; Regional Conference; 2010.

Professional Society Memberships

Association for Educational Communications & Technology *2010 – Present*

College Communicators

2004 – Present

International Society for Performance Improvement *2012 – Present*

Society of Technical Communication

2000 – Present

President, James River Chapter

2008 – 2014

Vice President & Programming Chair

2006 – 2008

Virginia Society for Technology in Education *2008 – Present*

Volunteer Activities

Volunteer Instructional Designer, Chesterfield Parks and Rec *2010 – Present*

Board Member, Christian Education & Technology,

St. David’s Episcopal Church (Midlothian, VA) *2016 – Present*