

Applying the First Principles of Instruction in a short-term, high volume, rapid production of online professional development modules

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Abstract The purpose of this paper is to describe a case study conducted to examine the application of Merrill’s First Principles of Instruction (Educ Technol Res Dev 50(3):43–59, 2002, First principles of instruction, Pfeiffer, San Francisco, 2012) to determine how they were implemented during a fast-paced project that required the creation of a large number of online modules. Design and development research (Richey and Klein in Design and development research, Routledge/Lawrence Erlbaum Associates, Mahwah, 2007) was employed to investigate the conditions and factors that impacted the decisions made by a design team including project leads, team leads, and instructional designers. Findings revealed that project requirements, personnel, physical setting, time, designer experience, training and team meetings influenced the use of the First Principles of Instruction.

Keywords Instructional design · First Principles of Instruction · Design and development research

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Introduction

The First Principles of Instruction are a prescriptive set of interrelated instructional systems design (ISD) practices that consist of activating prior knowledge, using specific portrayals to demonstrate skills, application of newly acquired knowledge and skills, and integrating the new knowledge and skills into the learner's world (Merrill 2002, 2009a, b, 2012). The central underlying principle is contextualizing instruction based on real-world tasks. Merrill hypothesizes that if one or more of these principles are not implemented, then a diminution of learning and performance will occur. However, most claims of efficacy in the application and use of ISD principles are anecdotal and empirically unsubstantiated (Klein and Richey 2015; Richey and Klein 2007, 2008). This phenomenon is not isolated to the First Principles of Instruction.

This article describes a design and development research study conducted to examine the use of Merrill's First Principles of Instruction (FPI) to determine how they were implemented during a fast-paced project that required the creation of a large number of online modules. Below we provide information about the First Principles of Instruction and describe a few research and development projects conducted to examine their use by designers. This is followed by a discussion of design and development research and how it can be used to study ISD principles and models.

Merrill's First Principles of Instruction

Merrill (2002, 2009a, b, 2012) systematically reviewed the abundance of ISD theories and models, research on learning and instruction, and common instructional design practices with the intent to discover the basic truths about learning and instruction. He assimilated the literature and identified a set of basic principles. The main criterion for the inclusion of a principle was that it had to support effective, efficient, and engaging (e^3) learning. Subsequent criteria included the general applicability of the principle in common instructional design methods, programs and environments (Merrill 2012). As a result of this lengthy review, five fundamental principles were identified and compiled to create the First Principles of Instruction:

- *Problem or task-centered* - Learning is promoted when students are engaged in solving real-world problems;
- *Activation Phase* - Learning is promoted when relevant previous experience is activated;
- *Demonstration Phase* - Learning is promoted when instruction demonstrates what is to be learned rather than merely telling information about what is to be learned;
- *Application Phase* - Learning is promoted when students are required to use their new knowledge or skill to solve problems;
- *Integration Phase* - Learning is promoted when students are encouraged to transfer the new knowledge or skill into their everyday life.

Gardner has described several projects in which the use of the First Principles of Instruction was examined. Gardner and Jeon (2009) discuss the design and development decisions they made while creating online training on using a suite of administrative tools (e.g. financial aid, registration, etc.) for a large university. They describe the conditions (i.e. environment, client requirements, obstacles) under which they applied FPI and the decisions they made in order to work around those conditions. Recognizing the difficulty in applying FPI in real-world instructional design settings, Gardner (2010) created a job aid consisting of a series of questions on how to apply the principles. The job aid contained questions like, “What real-world, relevant problem or task will the learners be able to perform when they finish this lesson?” “How will your students preview what they learn?” “How will you show the learners how to perform real-world problems or tasks?” (p. 22). Furthermore, Gardner (2011a) collected data on how award-winning college professors apply FPI in face-to-face courses. For the activation phase, professors identified outcomes from prerequisite courses and used that as the foundation to build new knowledge; reviewed content presented in prior class sessions; and began each class by asking questions about previously taught concepts. For the demonstration phase, some professors used worked examples while others had students demonstrate their work own products. During the application phase, some used real-world case studies. During the integration phase, professors used reflection, having students openly reflect and share their experiences with peers.

Others have discussed their use of the First Principles of Instruction. Mendenhall et al. (2006) developed an online entrepreneurship university course using FPI. The designers used real-world cases to help learners create business plans and eventually start their own businesses. The progression of tasks began with a simple business plan (i.e. a pig farm) to a very complex one (i.e. a restaurant). A pilot study was conducted comparing the online course using FPI to core business classes that taught the same concepts. Results indicated that the course using the First Principle was just as effective as the core classes. In addition, Kim et al. (2010) described how they applied FPI in an online English writing course for university students. They identified a series of simple to complex writing tasks. They applied the activation principle by choosing an everyday problem to solve. Examples and non-examples were used as the demonstration technique. For the application phase, learners completed writing assignments and peer evaluations. For the integration phase, students completed another writing task using their newly acquired skills.

Furthermore, Rauchfuss (2010) conducted an exploratory study that examined the correlation between the uses of FPI and years of work experience. Designers for this study represented the military, corporate, and higher education who had designed a course during the previous year. Rauchfuss evaluated courses submitted by the designers using Merrill’s (2009a, b) e^3 evaluation rubric. Findings revealed a significant correlation between years of experience and the use of FPI. Upon further examination, it was discovered that novice and expert instructional designers applied the demonstration principle equally but expert instructional designers were more likely to use the other principles (i.e. activation, application, integration, problem-centered). Additionally, Collins and Margaryan (2005) used FPI as the basis for evaluating 68 workplace courses designed by their organization. Results

indicated that designers applied the problem-centered, application, and integration principles more often than the activation and demonstration principles.

Design and development research

ISD model developers tend to postulate the validity of their model due to its logicity and being supported by literature (Richey 2005). This is the case with the First Principles of Instruction. Likewise, designers tend to equate the validity of a model with an appropriate fit within their environment; that is, if using the model is easy, addresses client needs, supports workplace restraints, and the resulting product satisfies the client then the model is viewed as being valid (Gustafson and Branch 2002; Richey 2005).

A number of scholars have suggested that empirical research should be conducted on ISD principles and models to advance the field and to add to our knowledge base (Driscoll 1984; Klein and Richey 2015; Reigeluth and Frick 1999; Richey and Klein 2007, 2008; van den Akker 1999). Design and development research seeks to create knowledge grounded in data methodically derived from practice. According to Richey and Klein (2007, p. 1) design and development research is the “systematic study of design, development, and evaluation processes with the aim of establishing an empirical basis for the creation of instructional and non-instructional products and tools and new or enhanced models that govern their development.”

Design and development research is an umbrella term for a wide range of studies that employ an assortment of research methods and strategies. Most design and development research tends to rely on qualitative strategies and deals with real-life projects, rather than with simulated or contrived projects (Klein and Richey 2015, Richey and Klein 2007, 2008).

There are two major categories of design and development research—product and tool research and model research. Model research studies focus on ISD processes and principles. Model research may address the validity of an ISD model, process or technique. In addition, these studies often seek to identify and describe the conditions and factors that influence the use of ISD approaches and principles (Klein and Richey 2015; Richey and Klein 2007, 2008).

Purpose of the current study

The purpose of the current study was to investigate the use of Merrill’s First Principles of Instruction (2002, 2012) and the decisions made by a design team including project leads, team leads, and instructional designers. The research questions were: What were the conditions under which the First Principles were used? What types of decisions were made during the project? What factors impacted the use of the First Principles?

Method

Research design

A case study method was used in this research project. A case study is a strategy of inquiry where a researcher explores a phenomenon in depth and holistically describes and analyzes information rich data (Creswell 2009; Merriam 1988). The researchers took an emic approach and retrospectively described the case. The term “emic perspective” means to take an insider’s perspective (Merriam 1998; Patton 2002). This perspective was necessary because the primary investigator worked as the lead instructional designer and also supervised other designers. Data were collected retrospectively since the development of the modules concluded before data were collected. Qualitative research techniques including interviews, surveys, and document analysis were employed during this case study.

A design and development research approach was used to describe the use of Merrill’s First Principles of Instruction and to examine their use within a specific context. As described by Richey and Klein (2007), this approach can be labelled as a model use study (i.e. the examination of a set of prescriptive ISD principles). The conditions and factors that impacted the use of FPI and the decisions made by designers were explored.

Context

The context for this study was an instructional design project that was federally funded through a state Department of Education in the southeastern United States. The project timeline was extremely short and required the creation of 49 online modules within a very strict 11-week timeframe. The major task was to use existing face-to-face professional development materials and convert them to online, independent study modules. The goal of the online modules was to familiarize teachers with new state standards and benchmarks in math and science as well as have the teachers incorporate appropriate instructional strategies into their lessons as they fulfilled the new standards.

Access to existing face-to-face materials was provided by the state Department of Education and was located on a professional development website. These existing materials consisted of content guides and slide presentations used for face-to-face professional development training. Much of the content in the existing materials included trainer pacing guides, subject matter notes, presentation guides, participant resources, and activity sheets. The existing materials focused heavily on the rationale for the new standards and differences between the previous standards. They relied on trainers to encourage audience participation and discussion. Consequently, specifics regarding the instructional strategies used were not included in the existing materials.

Participants

Participants for this study were 15 members of a design team that included project leads, team leads, and instructional designers. Participants were graduate students, recent graduates, faculty, and visiting scholars employed at a multidisciplinary research and development organization at a large research university in the southeastern United States. There were eight male and seven female participants and their average age was $M = 33.7$ years ($SD = 6$). There were five participants who had PhDs (four with instructional design related PhD degrees), seven with master's degrees (four with instructional design related master's degrees), and three with bachelor's degrees. Eleven participants were working towards either a master's degree or PhD (nine were pursuing degrees in instructional design). Twelve of the participants indicated they had previous instructional design experience. The average number of years of previous design experience was $M = 3.6$ ($SD = 5.6$). Two participants reported no previous design experience, six reported less than 2 years, five had 3–6 years, one reported 13 years, and one reported 20 years of experience.

Participants were purposefully selected based on their involvement with the project. Specifically, they contributed to the design of at least one professional development module. Some members of the project team completed other tasks (e.g. evaluation of modules, media selection and creation) but did not actually design any portion of a module. Those individuals were not included in this study. An additional selection criterion included the length of time the participant worked on the project. Participants had been employed on the project from the beginning and worked for at least 5 weeks.

Data sources

Designer data

A demographic survey was administered to participants online using a secure survey tool; the demographic data included age, gender, role in the project, education level, length of time working on the project, and years of design experience. To capture in-depth information about how the participants made instructional design decisions and the conditions under which those decisions were made, a 60-min semi-structured interview was conducted with each participant. During the interviews, participants were asked to describe the conditions under which they made instructional design decisions. Due to the relocation of the participants most of the interviews were conducted via Skype and recorded, with permission, for transcription. Each interview was audio recorded and transcribed. During the interview participants were asked about how they made design decisions, what factors contributed to making those decisions, and how they used the First Principles of Instruction.

Extant data

Project management documents including timelines, instructional designer assignments, quality control documents, instructional design templates and models, recorded WebEx meetings, and email communications were used to triangulate designer data. These data provided an insight on the conditions that contributed to the designers' decisions.

Data analysis

The interview and extant data were analyzed using qualitative analytical steps, as outlined by Creswell (2009) and a comparative analysis method suggested by Glaser and Strauss (1967). A comparative analysis method is when data are coded and analyzed concurrently. Coding is an iterative and interpretive process (Creswell 2008) and involves organizing the materials into segments and labeling the segments into categories.

In this study, an application called Dedoose (<http://www.dedoose.com/>) was used to organize and securely store the data online. This tool provided the researcher with the flexibility to code and to analyze the data concurrently. It allowed for the organization of interview text data, web conferencing recordings that used video and audio, and it linked the qualitative data to participant's demographic data to identify any patterns and reoccurring topics among participants. The application also quantified the codes by providing frequency counts, which assisted in the identification of the broader categories. The researcher analyzed each interview three times. First, during the initial interviews the researcher wrote memos identifying prominent topics brought up by the participants. Second, after participants checked the transcriptions for errors the researcher reviewed the transcripts and compared them with the original audio recordings and corrected any transcription errors. During this process more prominent topics were identified and the data were analyzed again. Lastly, a final coding and analysis took place. Once the interviews had been through a first-pass and second coding regime, the researcher then used a lean coding technique to aggregate similar codes and to eliminate redundant codes (Creswell 2008). After all of the data had been analyzed 237 codes were identified. These codes were then reviewed for redundancies and were aggregated into broader categories.

Results

Project conditions

The first research question focused on the conditions under which the First Principles were used. Analyses of interview and extent data revealed three themes focused on project requirements, personnel, and physical setting.

Project requirements

This project stemmed from the client's request to convert existing face-to-face professional development training materials to an online format. A critical requirement was that 49 online modules had to be created within an 11-week timeframe because funding for the project would be discontinued thereafter. Determining other requirements was difficult according to a project lead who indicated, "Part of the challenge was trying to figure out what the client really wanted and narrowing that down. That was actually a little bit tricky because they [the client] did not come out and say this is what we want." Additional requirements were determined by the project management team. These included embedding the modules into the client's existing online repository and course management system so users could complete them independently. A project lead indicated, "We had to really think of what's the best and we would propose it to [the client]. When we had our strategy, they were happy."

Project personnel

Personnel consisted of a project director, two project leads, six team leads, and 20 instructional designers. The project leads and team leads had multiple roles during the project (i.e. administrative tasks and instructional design tasks). Data revealed that prior obligations, scheduling, and excessive work hours were noteworthy conditions related to project personnel.

One of the team leads directed the recruitment effort to hire enough instructional designers to complete the project on time. He recruited designers from the university where this project took place. In order to hire 20 designers, allowances had to be made to their work schedules because all of them had prior obligations ranging from second jobs, additional projects, family commitments, college classes, and prior travel arrangements. A project lead said, "We wanted to accommodate otherwise they would say no to the project. Some of them [designers] we only got for 2 weeks and some for four, and some came in after 4 weeks, so it was too fluid."

Project leads worked 10–14 hour days for six and sometimes 7 days a week. On occasion they would work an 18-hour day. A team lead asserted, "We were requesting them [designers] to do things like work full time, but they were working 10 or 20 h, but we were... expecting them to do things like work 40 h every week."

Physical setting

During this project, there were two offices in which project personnel were housed—a main on-campus location and a secondary location at an off-campus research facility. The project leads and lead designers were housed at different locations. Review of e-mail communications, analysis of project management documents and researcher observations revealed that several designers telecommuted for the duration of the project. Many of them would come to the on-campus location for staff meetings while others would meet via web-conferencing. This arrangement was challenging for some of the team leads and designers.

Interviews indicated that participants felt that having all of the designers in one face-to-face location would have resulted in a more efficient work environment. A project lead said, “There was a core group [on-campus]. It was much easier for the lead designer and I to go through some things face-to-face... decision-making is facilitated face-to-face. Overall, it was really helpful to be face-to-face.” A team lead said, “My office was over at [the research facility]... but it really worked better if I was [on-campus] where I had direct access to the project lead and the team.” Moreover, a team lead suggested that productivity could have been improved if the designers worked together face-to-face; “It ought to be like working together and brainstorming together... instead of working separately.”

Decisions regarding the First Principles of Instruction

The purpose of the second research question was to determine the decisions that were made during the project. Analyses of data revealed two themes focused on strategic decisions and application decisions.

Strategic decisions

Decisions made by the project director, project leads, and lead designers were strategic in nature and impacted how the project functioned. These decisions related to hiring part-time, novice designers and simplifying the First Principles by creating a storyboard template that used a Tell-Show-Ask-Do framework.

The decision to hire part-time and inexperienced designers was due to (1) having enough personnel to complete the project on time, (2) experienced instructional designers were not available during the summer, and (3) bureaucratic procedures delayed the start of the project, and (4) full-time ID contractors had to accept other work. A lead designer was not in favor of hiring a large number of part-time, novice designers. She reflected on a conversation with the project director -

I approached the project director... about having fewer people but having them full-time... he wasn't opposed to the idea but I think he knew more than I did at that time, that these contractors... couldn't come on board full-time. We had to change our plan and try to get as many (graduate) students to make up a 40-hour work week.

During the initial phase of the project, the management team also determined the overall design approach for the modules. According to a project lead, they decided to use Merrill's First Principles of Instruction because of their belief that “a real-world, problem-centered approach would be most appropriate to teach this type of subject matter.” The management team was familiar with FPI and felt “there was a good chance for learner achievement based on previous use and research.” This decision led to the creation of a storyboard template using a simplified version of FPI (i.e. Tell-Show-Ask-Do framework). This was an important decision because inexperienced designers required specific guidelines as they designed the modules. It is worth noting that the storyboard template was created a few weeks after the project began.

Design decisions

Decisions made by designers related to the application of the First Principles of Instruction. Interview data revealed designers didn't think the modules fully incorporated FPI. One participant asserted -

I don't think we actually tried really hard to follow them [the First Principles]. At the end we didn't stick to the model really well. And from my understanding it did not have to follow the Tell-Show-Ask-Do. We could switch this around at some point, but then... we didn't really follow that well.

A lead designer agreed that the modules did not follow the First Principles as she had envisioned. She reflected on when she first received a module to review, "I received some of the modules just thinking 'oh my gosh, what did we do wrong', like in training the instructional designers... why is this so off? I think a lot of the instruction was just Tell, Tell, and Ask." However, the team leaders and designers felt that they did the best they could, given the constraints of the project. Moreover, designers felt the online modules were a great improvement compared to the existing face-to-face materials.

Activation/Tell

Designers indicated that the Activation/Tell principle was very easy to apply in the modules. Most of the content from the original materials were general information or Tell only. A team lead said, "The first two steps are easily adaptable... the beginning part (Tell-Show) but the last two parts are not easy." Another participant indicated that "there were no difficulties in the Tell part... it was the easiest part [to apply]." While designers agreed that the Activation/Tell principle was easy to apply some felt it was not conducive to good instruction. For example, a designer noted-

The word Tell sounds kind of like an information dump to me... I think that's a little boring for a learner. But at the same time, sometimes there really is no better way to disseminate information and put some things such as a benchmark. I can't think about a more creative way than telling them the benchmark, if that's what they need to know.

A team lead acknowledged that he struggled a little bit with the Activation/Tell principle because he didn't know the audience very well. He said, "I'm not one of them. So, this notion of giving them a couple of slides of content, I wondered if that was really doing it... The activation of the strategy I got, the activation of the content I wasn't sure."

Demonstration/Show

Team leads and instructional designers believed this principle was easy to apply. However, they felt restricted in their efforts to provide quality demonstrations. At the beginning of the project the management team suggested limiting the amount of videos created for demonstrations because of the time and resources it would take to

create a quality video. Many designers agreed that if there were more time they would add in more demonstrations. A lead designer reflected, “If I had to make a decision based on time, I would always try to put in demonstrations, you know, they really need to demonstrate and show these concepts.” A designer said she would also “add more videos and... create ways to demonstrate.” She continued by saying that the Demonstration/Show principle “was a little more difficult” because the modules couldn’t easily “show” how a teacher uses the strategy.”

Application/Ask

An activity was included in every module asking the learners to review the related standards and to reflect on the following questions:

- How would you implement these ideas into your classroom?
- What challenges do you anticipate encountering?
- How will you handle each of these challenges when they arise?
- Are there activities you’re currently using in your classroom that support teaching and learning of the standards?
- How will you incorporate the instructional strategy in your teaching?

According to a project lead, the standardization of the Application/Ask principle was to help “resolve the practice component which wasn’t part of the module.” A project lead, a team lead, and an instructional designer all mentioned the desire to have the application embedded within the online portal in order to assess teachers and provide them with feedback. Designers indicated that there was a need for more practice within the modules. One designer reflected that “due to the framework of the design [the activity] didn’t fit, and we were running out of time, so I changed it to a guided activity.”

Designers and team leads contended that the Application/Ask principle required more design expertise in order to apply it appropriately. A team lead said that the “first two steps (Tell-Show) are easily adaptable but third and fourth (Ask-Do) are not easily understandable and... I think [require] some experience to adapt or to apply.” A designer with no previous ID experience felt the Application/Ask principle was especially difficult to apply. She said, “Application parts can be improved... how can we apply this to the real-world?”

Integration/Do

For all of the modules there was one screen with an integration activity. The activity included two parts. First, it asked the learner to take a posttest. The posttest was not designed or developed as part of this project; an assessment team hired by the client created the posttest. During initial meetings the project director and a lead designer tried to convince the assessment team to create an assessment that provided teachers with a real-world task so they could apply their new knowledge. However, the assessment team felt the teachers should be tested on the subject matter domain (i.e. science and math concepts. The second part of the Integration/Do activity asked

teachers to apply their new knowledge by creating a lesson plan. They were asked to use a lesson planning tool embedded within the online portal to create and submit a lesson plan for the science or math standard and to plan the lesson using the instructional strategy they learned in the module.

Even though designers did not make many decisions regarding the Integration/Do principle, some recognized the difficulty in applying this principle. A designer stated, “I think we had the most difficulty on deciding what to do in the Do part.” A team lead said there were “difficulties for how to apply the Do part, how to prepare the Do steps while designing.”

Factors impacting decisions

There were several factors that impacted decisions regarding the use of the First Principles. Data analyses revealed five themes focused on time, designer experience, training and meetings, existing materials, and the online environment.

Time

Time was the primary factor affecting how the First Principles were applied in the online modules. The 15 individuals who participated in this study referenced time as a constraint 128 times during interviews. These 128 instances are in addition to the myriad of e-mails, recorded meetings, and personal conversations that also referenced time as a major constraint.

A project lead said, “Scope and time, that was always in the back of my mind... the time issue helped us make a scope decision. It was just amount of time that we needed, calendar time that we needed to have.” A lead designer concurred by saying, “Time obviously was a major factor in every decision that we made regarding what to put in, what to keep out.” A team lead stated, “We could be more creative if we and they [designers] had more time.”

Use of the Demonstration/Show principle was affected by the time constraint. Below are some comments made by designers -

[It] was very hard to do the show part because we were just basically writing down an activity that they should have done in person. And I think if we had a little more time to kind of be creative and coming up with more appropriate activity for the internet that would have been better.

If we had more time and more instructional designers we could be able to create more, better examples.

“I felt like if we’d had more time or maybe more resources I think using videos to actually show, accompanying that with narration or a breakout of bullet points, explaining, highlighting maybe certain points of your demonstration. I think we ended up doing a lot of text on the screen being narrated, which wasn’t maybe the most exciting or effective way.

A lead designer also indicated time was a factor related to the use of the Demonstration/Show principle. She indicated “Time was a major factor [in

deciding] how many demonstrations, what type of demonstrations because we really wanted more video demonstrations [showing] teachers using these instructional strategies. But we just didn't have time."

The use of the Application/Ask and the Integration/Do principles were also affected by time. A designer stated, "I know we could have done the [Application/Ask] part better had we had more time." A team lead stressed that, "The Ask and Do phases take more time and preparation." A second team lead said, "I believe we struggle with the Ask part when we have questions for [the learner]." A third team lead explained, "In some parts we would keep the same... in some parts if we had more time we would add a bit more detailed images or concept maps, more drawings, in Tell and Show parts and especially in Do part... so maybe we ignored the Do part in this project."

Designer experience

Designers had on average less than 4 years of instructional design experience and only two had more than 10 years of work experience. A lead designer said, for "the novice designers [this was their] first instructional design project outside of school and they were familiar with Gagnè. They were familiar with process models like ADDIE or Dick and Carey... they would try to make decisions based on their knowledge of those things versus their knowledge and understanding of First Principles."

Designers indicated that the First Principles were easy to understand and practical however, they were difficult to apply during this project. One instructional designer asserted, "I think the principles [are] very, very effective for this kind of project but I suggest the instructional designers have to learn them... and have to learn how to apply the principles." A team lead confirmed, "It's hard to apply an instructional design model... into the real world. That's the biggest problem I think we had. Many of the instructional designers in our team were really good experienced people but in the classes not in the real-world."

A team lead acknowledged that he knew what First Principles of Instruction were however; he "did not really fully comprehend how to apply these into instruction." Another said, "I know what they [First Principles] mean but now applying to the real projects, it was hard. I think that the ultimate issue would be that was my first time... designing instruction."

One designer said, "My biggest challenge was figuring out the Tell-Show-Ask-Do framework and how it related to the First Principles of Instruction." Likewise, a team lead said, "I did not grasp what we were trying to do. I kind of understood half way." Others suggested that after time and practice, their level of understanding FPI improved and the decisions regarding their use became easier. One team lead reflected that "Things got a little easier. We could determine how much is too much information." Another team lead concurred, "After sometime, they [the designers] understood."

Training and team meetings

A 3-h project kick-off meeting was conducted once the project funding was awarded and after the majority of designers were hired. Designers received an email before the project began with journal articles and a website that provided information about the First Principles of Instruction. Eleven designers reported reading one or more article and reviewing the website for 30 min or less. During the kick-off meeting designers were given an overview of the project, timelines, responsibilities, and expectations. In addition, an overview and training on FPI was provided. Designers were directed to use the First Principles as a framework for the online modules.

Interview data revealed that some designers thought that the training was helpful, but a majority felt the training didn't help them understand how to apply FPI. One designer said "I didn't get a whole lot out of the training. I'm not saying that the training wasn't good but what I'm saying is that there was so much going on... so for me it was not effective at all." Another revealed, "designers can understand the principles but if you taught it in detail [it would be] more helpful." Several designers indicated that the training would have been more useful if it helped them apply the First Principles of Instruction. Furthermore, a team lead recalled the initial training was fun but that it was "spray and pray." He added, "I think what we failed to do was not getting them to practice." However, a different team lead declared, "there's no way we had any time do that."

After the initial training took place, designers were assigned to project teams. Each team lead was asked to conduct meetings one or more times per week. Designers generally reflected positively on the individual team meetings because they were more intimate and a time to get specific questions answered. One team leader said, "I think the meetings were really helpful because we asked all questions that we were dealing with... these were the problems and we [would] try to find solutions for them or try to answer them." Another team lead reflected, "There were times that we had just team leader meetings when we would go over the model." A designer affirmed, "I think that having everyone around you where you can just say 'Hey, does this look right?' definitely was helpful more than stopping and sending it to someone [via e-mail]."

Three weekend work retreats took place where as many instructional designers that could attend would meet all day for 2-days and work on the modules. These retreats allowed designers constant access to the project lead, lead designers, and team leads. They also allowed designers to team-up with one another in an effort to quickly and efficiently produce the modules. A designer affirmed the usefulness of these retreats—"I definitely think the meetings that happened in physical space—when we went [to the retreats]... I think those weekend meetings were really helpful."

Existing materials

Designers indicated that the existing materials and their content impacted their decisions regarding the use of First Principles. A lead designer stated -

One of the challenges was just with the original materials themselves... all they had were discussion questions for in-class face-to-face discussions with the teachers. [We] had to fill in those gaps in order to put it online because that stuff was just not there in the original materials. I think that was a challenge for designers that would affect the way they used First Principles because the demonstrations weren't there in the original materials.

Online environment

The online environment affected decisions about the use of the First Principles. Specifically, the Application/Ask and Integration/Do principles were difficult to apply because the online portal where the modules were housed was limited in its ability to provide feedback and score the application activities. An instructional designer said, "I would say the online module, the format of online learning itself is also one of the challenges, because like I say, the do part and the ask part are pretty challenging."

A lead designer stated, "We wanted the modules to interact with it [the online portal] more, so that when [the teachers] were in the modules they could go along and do their lesson plans or we would have activities integrated—like more Ask parts... but we found out that wasn't possible... it [the online portal] wasn't set up to be able to store the information."

A designer said, "I think it [FPI] was a really good framework. Maybe with the exception of the Do, because it's hard to take an online module and ask teachers to demonstrate... The Do was left up to [the teachers]... ideally I think the Do would be excellent for face-to-face and a little bit harder to do online."

A team lead reflected, "Sometimes we couldn't clearly extract the pure knowledge part or we couldn't understand the application they provided in the paper-based (face-to-face) modules. And, of course, some applications were designed for the face-to-face sessions. So, we had to find an appropriate application for the electronic version of the modules, which was difficult for us."

Discussion

This study was conducted to examine the use of Merrill's First Principles of Instruction (2002, 2009a, b, 2012) to determine how they were implemented in a short-term, high volume, rapid production of online modules. Findings revealed that projects leads, team leads, and instructional designers felt that the modules didn't fully incorporate FPI. Participants thought the First Principles were easy to understand yet difficult to apply given the conditions of the project. Below we discuss a few of the main factors that influenced the application of FPI and provide some implications related to our findings.

Time had a major impact on the application of FPI. Every participant mentioned that there was a lack of adequate time to sufficiently apply the principles. As a lead designer said, "every decision that we made regarding what to put in, what to keep out" was influenced by time. This finding provides support for other scholars who

indicate that time is a major factor in the use of ISD principles. Gardner (2011b) reported that time constrained his use of the First Principles when designing an undergraduate biology course. Richey (2005) suggested that it is difficult for designers to apply an ISD model especially during a fast-paced project with a tight timeline. Wedman and Tessmer (1993) reported that instructional designers often eliminate certain tasks based on the amount of time allotted for a project. An implication of these findings is that reasonable project deadlines must be set especially when designers are required to closely follow an ISD model. While many design projects have strict deadlines, these can often be negotiated and adjusted with the client's approval. That was not the case in the current project.

Designer experience also contributed to the use of the First Principles. This supports the work of others who have studied the use of these principles. Rauchfuss (2010) found a significant correlation between years of experience and instructional designer use of FPI. Gardner (2011a) reported that knowledge and experience is an important factor when the First Principles are applied by award winning professors in higher education. Rowland (1992) indicated that the use of ISD processes "are affected by many factors, among them the designer's knowledge, skill, and experience" (p. 82). Likewise, Richey (2005) and Edmonds et al. (1994) specified that some ISD approaches and models are better suited for experienced designers. Furthermore, Gibbons (2003) suggested that novice designers are typically media-centric, which means they focus on delivery methods rather than on models and strategies (Gibbons 2003). Some participants in the current study reported concentrating more on the challenges of converting the face-to-face courses to the online environment rather than the use of the First Principles. An implication of our findings is that managers should hire knowledgeable designers especially when a project is short-term, high volume, and rapid production. Yet the constraints of the current project (availability of experienced designers, scheduling conflicts) impacted this decision.

Training and team meetings also influenced the use of FPI. However, several participants felt that initial training was insufficient because it did not follow the First Principles. Rowland (1992) notes that, "[most] efforts to train designers and to assist designers in their work are based on theory that may be discrepant from practice" (p. 66). When feasible, training directed at novice designers should include application practice before they are required to integrate ISD principles such as FPI. Regular team meetings and weekend work retreats should also be scheduled when practical. Several participants in this study mentioned that face-to-face meetings and retreats were helpful because they provided opportunities for collaboration, feedback, and coaching.

Conclusion

The practice of ISD is empirical. From analysis to evaluation, data are collected using a scientific problem solving approach. However, little research has been conducted to examine ISD models, processes, and principles (Klein and Richey 2015; Richey and Klein 2007). This study focused on how a team of designers

applied Merrill's First Principles of Instruction in a short-term, high volume, rapid production project. It's not surprising that project requirements, time, experience, training, and the work environment influenced design decisions. These conditions are often present in everyday instructional design projects. Our findings provide empirical evidence for the conditions and factors that impact the use of the First Principles of Instruction in a real-world ISD project.

Compliance with ethical standards

Conflict of interest This research study was not funded and there is no conflict of interest.

References

- Collins, B., & Margaryan, A. (2005). Design criteria for work-based learning: Merrill's First Principles of Instruction expanded. *British Journal of Educational Technology*, *36*(5), 725–738.
- Creswell, J. W. (2008). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*. Upper Saddle River, NJ: Pearson Education.
- Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches* (3rd ed.). Thousand Oaks, CA: Sage Publications.
- Driscoll, M. P. (1984). Paradigms for research in instructional systems. *Journal of Instructional Development*, *7*(4), 2–5.
- Edmonds, G. S., Branch, R. C., & Mukherjee, P. (1994). A conceptual framework for comparing instructional design models. *Educational Technology Research and Development*, *42*(4), 55–72.
- Gardner, J. L. (2010). Applying Merrill's First Principles of Instruction: Practical methods based on a review of the literature. *Educational Technology*, *50*(2), 20–25.
- Gardner, J. L. (2011a). How Award-winning professors in higher education use Merrill's First Principles of Instruction. *International Journal of Instructional Technology and Distance Learning*, *8*(5), 3–16.
- Gardner, J. L. (2011b). Testing the efficacy of Merrill's First Principles of Instruction in improving student performance in introductory biology courses. (Utah State University). ProQuest Dissertations and Theses, Retrieved from <http://search.proquest.com/docview/862644295?accountid=4840>
- Gardner, J. L., & Jeon, T. (2009). Creating task-centered instruction for web-based instruction: Obstacles and solution. *Journal of Educational Technology Systems*, *38*(1), 21–34.
- Gibbons, A. S. (2003). What and how do designers design? *TechTrends*, *47*(5), 22–25.
- Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research*. Piscataway, NJ: Transaction Publishers.
- Gustafson, K. L., & Branch, R. M. (2002). *Survey of instructional development models* (4th ed.). Syracuse, NY: ERIC Clearinghouse of Information & Technology, Syracuse University.
- Kim, C., Mendenhall, A., & Johnson, T. E. (2010). A design framework for an online English writing course. In J. M. Spector, D. Ifenthaler, & Kinshuk (Eds.), *Learning and instruction in the digital age* (pp. 345–360). New York, NY: Springer.
- Klein, J. D., & Richey, R. C. (2015). Design and development research. In J. M. Spector, T. Johnson, D. Ifenthaler, W. Savenye, & M. Wang (Eds.), *Encyclopedia of educational technology* (pp. 183–184). New York: Sage.
- Mendenhall, A., Buhanan, C., Suhaka, M., Mills, G., Gibson, G., & Merrill, M. D. (2006). A task-centered approach to entrepreneurship. *TechTrends: Linking Research & Practice to Improve Learning*, *50*(4), 84–89.
- Merriam, S. B. (1988). *Case study research in education: A qualitative approach*. San Francisco: Jossey-Bass.
- Merriam, S. B. (1998). *Qualitative research and case study applications in education*. San Francisco: Jossey-Bass Publishers.
- Merrill, M. D. (2002). First Principles of Instruction. *Educational Technology Research and Development*, *50*(3), 43–59.
- Merrill, M. D. (2009a). First principles of instruction. *Educational Technology*, *46*(4), 5–10.

- Merrill, M. D. (2009b). Finding e3 (effective, efficient and engaging) Instruction. *Educational Technology*, 49(3), 15–26.
- Merrill, M. D. (2012). *First Principles of Instruction*. San Francisco, CA: Pfeiffer.
- Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage.
- Rauchfuss, G. H. (2010). How principled are designers? A study of instructional designers use of first principles. Capella University). ProQuest Dissertations and Theses, Retrieved from <http://search.proquest.com/docview/741708813?accountid=4840>
- Reigeluth, C. M., & Frick, T. W. (1999). Formative research: A methodology for creating and improving design theories. In C. M. Reigeluth (Ed.), *Instructional design theories and models, Volume II: A new paradigm of instructional theory* (pp. 633–651). Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.
- Richey, R. C. (2005). Validating Instructional Design and Development Models. In J. M. Spector, C. Ohrazda, A. Van Schaack, & D. Wiley (Eds.), *Innovation in instructional technology: Essays in honor of M. David Merrill* (pp. 171–185). Mahwah, NJ: Lawrence Erlbaum Associates.
- Richey, R. C., & Klein, J. D. (2007). *Design and development research*. Mahwah, NJ: Routledge/Lawrence Erlbaum Associates.
- Richey, R. C., & Klein, J. D. (2008). Research on design and development. In J. M. Spector, M. D. Merrill, J. van Merriënboer, & M. P. Driscoll (Eds.), *Handbook of research for educational communications and technology* (3rd ed., pp. 748–757). Mahwah, NJ: Lawrence Erlbaum.
- Rowland, G. (1992). What do instructional designers actually do? An initial investigation of expert practice. *Performance Improvement Quarterly*, 5(2), 65–86.
- van den Akker, J. (1999). Principles and methods of development research. In J. van den Akker, R. M. Branch, K. Gustafson, N. Nieveen, & T. Plomp (Eds.), *Design approaches and tools in education and training* (pp. 1–14). Dordrecht: Kluwer Academic Publishers.
- Wedman, J., & Tessmer, M. (1993). Instructional designers' decisions and priorities: A survey of design practice. *Performance Improvement Quarterly*, 6(2), 43–57.

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