

Instructional Design Considerations
When Selecting Learning Technology

Amy Kidder

University of North Texas

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Abstract

This paper explores the importance of having a sound learning strategy when selecting technology as a method of delivery. The emphasis of performing a thorough needs analysis of the learning content by evaluating the learner and their environment is also explored. A needs analysis is key for an instructional designer to create a learning strategy that increases learner engagement, motivating the learner to achieve the defined objectives. The instructional designer must ensure that learning exercises, tasks, and methods of using the technology have a purpose and can assist in achieving outlined learning objectives. Technology can support the learning experience by bridging the gap between learner engagement and content. When choosing the technology, there are various considerations an instructional designer or educator must consider to meet the needs of the learner. Different technology tools are examined in this paper including each tool's strengths, weaknesses, and alignment with instructional strategy.

Asynchronous and synchronous environments are also considered to assist in determining the most effective learning technology tools. The research and studies referenced in this paper support the importance of considering various learner traits in the selection of the appropriate learning technology.

Keywords: instructional design, learning technology, needs analysis, technology considerations, learning strategies, technology strategies, learner

Instructional Design Considerations When Selecting Learning Technology

It is generally accepted that technology does not support learning on its own. Only when technology is integrated into a learning environment does the full potential of technology for learning become realized (Voogt, & Knezek, 2008). Malm and Defranco (2012) state, “The next generation of students will not just be concerned about if technology is used, but rather how it is incorporated into the educational experience” (p. 404). Technology can support the learning experience by bridging the gap between learner engagement and content.

It is important that Instructional Designers (ID) and educators who are selecting learning technology for delivery methods create a comprehensive instructional strategy before choosing their technology. An ID should perform both an instructional and technical learning strategy before choosing learning technology. Consideration should be taken to different learning styles of their audience, as well as the wide range of audience demographics. Before selecting a learning technology tool, an ID should consider age, gender, audience size, consolidated versus a distributed workforce, the training purpose, learner characteristics, and the learning technologies available (Holden & Westfall, 2010). Every effort should be made to ensure that the learning technology is appropriate for the learners. Understanding learning styles and the role of effective learning technology in the teaching/learning process is important to creating an effective learning program (Csapo & Hayen, 2006). Csapo and Hayen (2006) discuss how learning cannot be successful without a knowledge of the various learning styles and pairing them with

the proper learning and technology strategies. This paper reviews the various learning styles and environments that an ID should consider when choosing an effective learning strategy that includes technology.

Instructional and Technical Learning Considerations

The learning technology selection process is a systematic approach and an essential element of the instructional design process. When identifying the most appropriate learning technology, consideration must be given to many variables that may influence the selection of one technology vehicle over another (Holden & Westfall, 2010). Holden and Westfall (2010) explain how using a systematic approach to technology selection ensures that appropriate learning technology is selected to achieve the desired learning objectives. When assembling a learning strategy, the ID should consider and evaluate different criteria that include instructional and technical learning considerations. Areas to consider are the learner demographics, complexity of content, learning objectives, learning strategy, identification of knowledge and skills gaps, level of interaction, and effective assessment and measurement tools. Technical considerations involve cost, availability and access to technology, and audience size/distribution. After all variables are evaluated, the ID can then determine their learning strategy.

To start the process of creating an instructional design strategy, a thorough needs analysis should be performed to ensure the appropriate technology is selected so that the learning objectives are obtained. A needs analysis is the start of the instructional design process performed to determine priorities, make improvements, or allocate resources. It involves determining the needs, or gaps, between the learner's current state, and the

fullest potential of the learner. At the very beginning of the instructional design process, the ID must design a learning strategy to address the needs (or closing the gaps) to bring the learner closer to its desired future state (Learning Needs, n.d.).

Learning Needs Analysis

The most important factor in a successful implementation of the instructional strategy model is having highly trained, skilled, and knowledgeable instructional designers who are familiar with learning theory, specifically in the first step of the process, the needs analysis phase (McCombs, 1986). After a strategic analysis is completed, and the assessment of training or system requirements is evaluated, the next steps for design, development, implementation and evaluation is created. The needs analysis should incorporate the selection of appropriate technology. Alonso, López, Manrique, and Viñes (2008) explain that the needs analysis phase defines what should be taught, analyzes the learner, and educational contents. In this phase (Alonso et al., 2008), the needs analysis purpose is to detect the learner's learning characteristics and needs, discover what environment the learning will take place, and what resources are available to the learner. How the learner processes information, how well they learn, and how they retain knowledge, is directly related to the learning style of the individual (Manner, 2001).

It is necessary to consider both instructional and technical strategies when selecting the right learning technology to deliver learning objectives. The instructional designer must evaluate and consider specific learner criteria during the needs analysis to make sure the correct delivery tools are chosen so that learning objectives are obtained

(Holden & Westfall, 2010). Using a strategic approach in the instructional design process will ensure the appropriate technology is selected for delivering effective learning solutions.

An instructional designer should have the skill set to analyze the range of learning problems, learning theories, and approaches. It is similar to the fact that a scientist cannot prove a theory without the appropriate scientific approach and analysis; the instructional designer cannot properly recommend an effective learning approach without an accurate analysis of the gaps and possible solutions. Being able to take learning theory and turn it into effective learning would be easy if the learning process was not so complex. Learning is a complex process that has generated numerous interpretations and theories of how it is effectively accomplished (Ertmer & Newby, 2013). For instance, when selecting your learning approach and methods of delivery, make sure you have a reason to use technology. The technology and learning exercises should remain relevant to the learning process, which is the goal of the needs analysis. Do not become enamored with technology and the associated bells and whistles; ensure that learning exercises, tasks, and methods of using the technology have a purpose and can assist you in achieving your overall learning objectives.

Conducting a needs analysis. O'Reilly (2016) explains how conducting a needs analysis is one of the first steps in setting learning goals or developing strategic plans. A needs analysis is defined as an evaluation of an organization's current environment relative to the preferred environment, with the difference between the two identified as the organization's needs (O'Reilly, 2016). From this definition, the goal of the needs

assessment is to verify existing capabilities and determine the gap that exists, between the current state and desired future state. The needs analysis accomplishes more than just identifying a gap. It also serves to (O'Reilly, 2016):

- Provide guidance for learning activities
- Allow leaders and educators to determine priorities and allocate their resources to learning tasks that will have the greatest impact
- Align goals, strategies, and desired outcomes
- Assess current state data metrics and desired future state data metrics to determine if learning objectives were met (p. 131)

Developing and executing the needs analysis is often the most important and time consuming step in the process of setting learning technology related goals for a specific learning program. An instructional designer must determine what stakeholders are involved in the process, what the process will look like, and the desired outcomes (O'Reilly, 2016). If the instructional designer does not take the time in this stage to review and identify all content related to the project, there is a possibility it could lead to misaligned learning objectives.

The needs analysis can include data collection from many sources. Existing documentation, process, and learner demographics are typically available through your stakeholders and business sponsors of the project. Interviews and focus groups provide additional information on current state of the learners. Surveys remain the most common form of needs assessment, as they are relatively easy to administer and provide data in a usable format (O'Reilly, 2016).

An example of what might be discovered in a needs analysis is that some combinations of technology (e.g. text and graphics) compete for attention and therefore increase the cognitive load for the student. Other combinations of technology, such as audio and visual graphics, support one another and promote more effective learning (Merrill, 2002). Through the needs analysis, the ID will also discover where (the location) the learning should take place and the learning style of the students. Students could be dispersed across the country, work from home, in factories, and could be baby-boomers or millennials. All of these factors play a role in creating an effective learning strategy.

Below are some examples of needs analysis questions for selecting the appropriate learning technology (Knight, 2009):

- What are the curriculum objectives?
- What other outcomes are desired?
- Where will the activity take place?
- What resources are available?
- What technologies are available?
- What approach will be taken?
- What assessment strategies will be used?
- How will learners be supported during and after the activity? (p.47)

The questions above can assist an ID in capturing the information needed to create a robust approach to the learning design. After a comprehensive needs analysis is performed and a learning strategy is in place, it is now time to select the appropriate

technology for your learning solution. The next phase is choosing your learning technology tools.

Selecting Your Learning Technology

Selecting the appropriate learning technology is imperative so the learner can easily achieve the learning objectives. For the online learning and teaching experience to be effective, it is critical that any decisions regarding the choice of technology be well thought out, and that the technology is appropriately integrated into the learning activities (Watson, 2011). Learning technology comes in many different forms and vehicles. This can include online tools such as eLearning, social media, videoconferencing, podcasts, and many other formats. They can be individually paced and have a varying focus of instruction (Holden & Westfall, 2010).

Since the early 1980's, there has been an increasing interest in using technology for instructional purposes (Reiser, 2001). Many instructional design professionals (during this time) turned their attention to instruction using technology. Some instructional designers felt it was important to use the computer as a tool to automate selected learning tasks, while others concentrated on developing new models of the instructional design process to ensure technology was selected and implemented correctly. ID's knew the importance of strategically selecting the appropriate technology and implementation was key to meeting learning objectives.

Technology strategies have been proven to positively impact learning. The use of Learning Management Systems (LMS), PowerPoint slides, blogs, webinars, videos, and podcasts have been proven to engage students more actively and challenge them to think

more critically as they learn and construct new knowledge (Lumpkin, Achen, & Dodd, 2015). How you choose which technology to use can depend on a number of factors such as (Watson, 2011):

- The intended learning outcomes (determined from your needs analysis)
- Learner demographics (location, access to technology, number of learners, age, etc.)
- The activities or technical requirements of the course content (such as large graphic files, collaborative tools, live chat features, file sharing, discussions boards, etc.)
- The teacher's previous online or training experience
- The requirements of the establishment regarding the use of different technology (p. 2)

Learning Technology Delivery Modes

It is important to consider the environment where the learner will receive instruction. Technology-based learning is grouped into synchronous and asynchronous delivery modes (Koller, Harvey & Magnotta, n.d.). Woodall (2012) examines both delivery modes. The synchronous (real time) mode is the more traditional approach to online training where the instructor and learner are available at the same time. They can be in the same room where the learners can experience and interact with one another. They can also be remote and interacting at the same time. Online synchronous training works very well for learners who want to get away from the traditional classroom environment. Asynchronous (different time) means that the instructor and the learner are

available at different times, a benefit for self-directed learners that like to learn at their own pace and own time. A well thought out learning solution should consider both learning modes when selecting their technology delivery method.

Woodall (2012) discusses how synchronous learning delivery occurs when instructors and learners meet at a specific time in a virtual classroom, in person with computers, or conference calls. In a technology-based learning setting, synchronous learning occurs via lectures, teleconferences, video conferences, or webinars. In webinars and web conferences, audio lectures are often accompanied by slides and sometimes a video image of the instructor is streamed to the learner's desktop. Due to low costs, synchronous training has become the fastest growing segment of the technology-based learning market.

Asynchronous learning in a technology-based learning environment does not need to happen at a specified time and is not linked to a specific learning event (Woodall, 2012). Self-paced asynchronous applications include web-based and computer-based courses that learners use on their own time. Examples of asynchronous learning applications range from a simple e-mail dialog or a discussion via a web-based bulletin board to a comprehensive learning environment where the instructor posts assignments and then monitors students' progress over time. An advantage of asynchronous technology-based learning is that it is not constrained by timing or geography. Learners can begin a course when they are ready for it and advance through it as quickly or as slowly as their own time and ability permit.

Below is an example of synchronous and asynchronous learning methods for technology-based learning.

Synchronous and Asynchronous TBL Delivery Methods

Synchronous	Asynchronous
Teleconferencing	E-Mail
Conference Calls	List servers
Web conferencing	Threaded discussions
Instant Messaging	Blogs
Chat	Discussion Forums
	Podcasts
	Simulations

Table 1: Synchronous and Asynchronous TBL Delivery Methods (Koller et al., n.d.)

Learning Technology Delivery Tools

An instructional designer or teacher should evaluate their technology-based learning tools based on their instructional design strategy determined from their needs analysis. Below is an evaluation of strengths and weakness for a variety of technology-based learning methods based on the need of the learner and environment. It also provides the instructional strategy associated with the learning technology tool (Holden & Westfall, 2010):

- **Web-based**

Strengths: self-paced instruction, drill and practice, remediation and intervention.

Weakness: internet connectivity, computer literacy, bandwidth limitations.

Instructional Strategy: lectures, demonstrations, simulations, illustrations, tutorial.

- *Audio-conferencing*

Strengths: quick updates to content, instructor/learner interaction.

Weakness: engagement, not visual, doesn't use all instructional strategies.

Instructional Strategy: lecture, discussions, brainstorm.

- *Computer-based*

Strengths: visual/audio, video, student-paced, immediate feedback, reinforcement.

Weakness: no instructor interaction, high development costs, student isolation.

Instructional Strategy: lecture, case study, demonstration, illustration, simulation.

- *Podcasts*

Strengths: audio can be continually reviewed, inexpensive, high reach.

Weakness: no graphics or video.

Instructional Strategy: lecture, case study.

- *Video*

Strengths: access to continued content review, self-paced.

Weakness: high cost, frequently outdated, no instructor interaction.

Instructional Strategy: lecture, case study, illustration.

- *eLearning*

Strengths: continued content review, self-paced, interactive, high reach.

Weakness: high cost, frequently outdated, no instructor interaction.

Instructional Strategy: lecture, case study, guided, simulation, demonstration, drill and practice.

- ***Virtual Reality***

Strengths: immersion, problem-solving, experience, interactive.

Weakness: high cost, complex design.

Instructional Strategy: simulation, demonstration, drill and practice. (p. 20-27)

After your learning technology is selected, you must assess whether or not you used the correct technology approach to deliver your training. If you performed a thorough needs analysis and crafted a strategic learning solution with appropriate technology, you should have a positive learning outcome. It is encouraged that an evaluation and assessment is performed after your learning is deployed to gain feedback on whether your learning strategy accomplished its objectives with the learners.

Strengths and Benefits of Choosing the Correct Learning Technology

Once your delivery mode and tools have been selected, and your learning strategy implemented, you can evaluate whether or not you have had a successful implementation and learning objectives were met by the learners. It is encouraged to send learners evaluations to get direct feedback on engagement and effectiveness of the learning activities. In doing that, you can assess the strengths and benefits along with the areas of opportunity from your learning technology approach.

Strengths and Benefits of Learning Technology

The advantages of learning technology are obvious to many instructional designers and educators. Koller et al., (n.d.) examines how for synchronous events, both

infrastructure and event costs for live webinars are far lower than classroom or in-person events. For asynchronous delivery, costs are far lower online or through an LMS than via distributed videos. Content maintenance costs are sometimes higher than the original content design costs. In an online live-environment, changes and updates are done without any delays and at a much lower cost. This is particularly essential for time-sensitive corporate training (Koller et al., n.d.).

There are many advantages to learning technology if selected with the correct instructional strategy (Koller et al., n.d.):

- Accessibility (anytime and anywhere delivery)
- Self-paced and matched to the learners' needs
- Full scalability
- Timely dissemination of up-to-date information
- Streamlined and effective learning delivery (p. 6)

The U.S. Department of Education (2014) discusses how effective learning environments bring out learner's ideas and related experiences while providing new experiences that cause them to question those ideas, helping them to understand that there may be common situations they are not yet able to explain. This can set the stage for students to use new knowledge and modify their existing ideas, creating continuous learning. An example is using Blackboard as a method of learning delivery in online college courses. Students can receive assignments, research content, and share their own ideas in this learning technology tool. In turn, they can review other students research and ideas, and continue to create new learning opportunities which evolves their learning

as they acquire more knowledge. Technology can support this process by providing a mechanism for students to research different theories and collaborate using each student's responses. Technology can then provide students with alternative arguments and examples different from their ideas and theories that the student may have determined through their research. In addition to providing examples to the students, technology-based learning systems can also support the customization of the student learning experience by analyzing students' performance on recent tasks and suggesting learning activities, resources, or approaches that are custom matched to each student's profile of skills and competencies. Feedback is important in the growth and development of the learner.

In addition to tailoring instruction to each learner, technology can also support differing student capacities, and open learning opportunities to students with disabilities and others who have traditionally been excluded. Technology is not only used as a way of tailoring to the students learning needs, but learning technology is also intended to enhance the appeal of learning through increased engagement (Molenda, 2009).

Technology can be vital to ensure the learners are engaged and the appropriate tools are chosen for the audience.

Shortcomings of Learning Technology

Although there are many positive uses of technology in learning, there are a few shortcomings of using technology as a learning tool. An example of a technology shortcoming is when too much interaction can cause learners to feel overwhelmed and result in cognitive overload if courses are not designed appropriately. Another example

is when there is the absence of interaction in learning through technology, which may leave students feeling isolated when provided in an asynchronous environment (Warren, Dondlinger, McLeod, & Bigenho, 2012). The phrase “death by PowerPoint” is often used in the corporate world because leaders will stand up and present what they consider “training”, which is a large amount of content on every slide as they believe the learners need to know everything. There is not an effective learning strategy around the delivery of information in the PowerPoint tool. Again, this is not at the fault of the technology, but the fact that a sound instructional strategy was not used when considering the instructional method.

Systems training is a great example of where learning technology can be effective (strength) and expensive (shortcoming). Typically, as with most technology, system applications change through upgrades in the applications and processes. To that point, using technology to present training via a webinar is an inexpensive and efficient method to guide someone through systems learning content. A potential shortcoming is if the instructor decided to develop an eLearning course around a rapidly changing application. This can get expensive to update and keep maintained for current learning. Cost can also be a negative factor in the use of learning technology, although many have found that technology with a dispersed workforce is a cost savings opportunity. Overall, it appears that there are many more advantages to using learning technology when complimented with a rigorous instructional strategy.

Conclusion

In summary, it is extremely important to consider all aspects of the learner when choosing the appropriate learning technology. The instructional designer should evaluate and consider specific criteria during the needs analysis to make sure the correct technology tools are chosen so that learning objectives are obtained. Using a strategic approach in the instructional design process ensures the appropriate technology is selected for delivering effective learning solutions.

It is important to consider both instructional and technical strategies when selecting the right learning technology to deliver learning objectives. If an instructional designer does not assess all considerations, the learning strategy will most likely fail. A comprehensive needs analysis will establish the foundation in creating effective learning solutions.

Technology is not the end-all be-all and cannot, by itself, produce the benefits we seek in learning. However, without technology, instructors will have little chance of meeting the modern learners needs, and reaching a dispersed learning population. The integration of both instructional and technology strategies consistently demonstrates the potential for positive effects when technology is a key factor in well-designed learning strategies. Effective design strategies encourage the use of learning technology that focus on specific connections to learning processes and address all the factors in learning objectives (U.S. Department of Education, 2014).

In the future, the advancement of technology in both education and the workforce will make instructional designers think more about creating real-world situations to

promote learning and problem-solving with technology as a delivery mechanism (Spector, 2008). Wainwright (n.d.) explains that technology helps the teachers prepare students for the real-world environment. As the world becomes increasingly more technology-dependent, it becomes even more necessary that, to be successful, instructional designers must effectively incorporate the use of learning technology in their strategy.

If we are going to continue to use technology, we must use it responsibly. Using it responsibly means using technology with a strategic learning approach that includes the technology considerations discussed in this paper. As the research and studies in this paper support the importance of considering all aspects of the learner when selecting the appropriate learning technology, this has reinforced the importance of having an overall sound learning strategy before selecting learning technology.

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