Analyzing and Evaluating the Phases of ADDIE

T. Dousay & R. Logan
University of Georgia, USA. teedee@uga.edu

Abstract
Even after decades of authors creating their new models of instructional design, ADDIE remains one of the most commonly taught processes to instructional systems students. The ADDIE phases showcase the most important steps taken when designing and implementing instruction. Many scholars focus on the importance of employing a systematic approach to identify a performance gap and prescribe an instructional intervention. This approach includes the concept of evaluation and the process of formatively correcting issues along the way while also providing summative feedback to the stakeholders. Yet, as the field of instructional systems continues to grow, ADDIE is continually attacked with arguments against what is perceived as a simplistic view on design and development. However, a university in the southeastern United States currently encourages students to use ADDIE as they engage in an experiential learning activity. This case study examines how one team of students redesigned training for a community nature center from analysis of the nature center operations and volunteer trail guide performance to implementation of the newly developed training. Evaluations were conducted at the conclusion of each phase and the final report included summative evaluation tools for the project. Ultimately, the students were able to use the systematic approach prescribed in ADDIE to build an effective instructional product that successfully met with stakeholder's expectations.

Keywords:
Instructional design, ADDIE, systematic process, instructional systems

Instructional Design

Defining and creating models of design intended to improve instruction has fascinated practitioners for the last 50 years. Barson (1967) was perhaps the first to introduce the phrase *instructional development*, defined as the systematic process for improving instruction, as part of a project at Michigan State University. Shortly thereafter, Twelker, Urbach, and Buck (1972:5) noted that a systematic approach to developing instruction was a popular idea, but cautioned that instructional design methods varied from simple to complex. In an overview of the history of instructional design, Reiser (2001:57) found that a variety of sets of systematic instructional design procedures had emerged in a relatively short four decades. The reason for this rapid acceptance is perhaps due to the nature of models and their ability to simplify complex realities and apply generic components across multiple contexts (Gustafson & Branch, 2002:1). Out of hundreds of instructional design models available, Gustafson and Branch (2002:xv) reviewed only 15 different models of instructional design based on historical significance, unique structure, or frequent citation in literature. However, at the root of this survey is the assumption that, "models serve as conceptual, management, and communication tools for analyzing, designing, creating, and evaluating guided learning, ranging from broad educational environments to narrow training applications." The progression of analyzing, designing, developing, implementing, and evaluating (ADDIE) forms the basic underlying process that is a distinct component of instructional design regardless of specific model used (Gustafson & Branch, 1997:74). With such a rich history that continues to evolve, the framework of ADDIE provides a solid foundation for the instructional design process.

Whether by necessity to address the growing field of instructional development or out of a natural progression, an introduction to instructional design is a part of training in higher education. Richey, Klein, and Tracey (2010:1) note that instructional design is now an established profession and area of study. Within the field of study, experts often refer to and/or create models as a tool to guide learning in instructional design (Magliaro & Shambaugh, 2006:83). However, with so many different models of design available, it is important for novice designers to understand the foundations of instructional design before seeking to apply the knowledge. At a university in the southeastern United States, the training approach introduces instructional design with an overview of ADDIE followed by an experiential learning activity that requires students to work as a project team for a vetted client with an instructional problem. Through analysis, initiative, and immersion, students are able to quickly assimilate details and assumptions into practice. Students are encouraged to explore established instructional design models and use the method they feel is best suited for their specific application.

The purpose of this descriptive case study is to recontextualize the meaning, value, and applicability of ADDIE as the foundation to instructional design within the framework of one of the experiential learning activities. The objectives of this study framed as questions are as follows:

1. Were the five phases of ADDIE followed as prescribed by the literature?
2. Were other models of instructional design referenced or applied during the experiential learning activity?
3. What challenges arose as a result of engaging in the experiential learning activity?

Data collected for this study include project team notes, comments, and products as well as documented feedback from the project stakeholders. The structure of this case study is written in a unique approach so as to align the process and findings with the individual phases of the process itself, analysis, design, development, implementation, and evaluation. Findings incorporate decisions made by the project team and justification for each action.

Experiential Activity

During the fall academic term of 2009, a student-led team evaluated the instructional needs of a volunteer program at a community nature center. A total of four students, one undergraduate, one master's student, and two doctoral students, worked cooperatively over the course of eight weeks to analyze the center's volunteer training program and propose recommendations based on observed gaps. Under the guidance of the course instructor, the project team agreed to a generic ADDIE approach in order to facilitate the team's understanding of more specific instructional design models.

The following overview of the project adds to the context of this case study. The community nature center is a 225-acre property that serves the community as a wildlife sanctuary and an environmental education center. The goal of the community nature center is to provide area children with opportunities for a variety of positive outdoor learning experiences in a personal, supportive atmosphere. This goal is carried out through the use of volunteer trail guides. The volunteers must learn local flora and fauna, and learn teaching and group management skills for a broad age range. The nature center provides intensive training sessions twice per year for new guides, but guides unable to participate in training may observe walks led by other volunteers, read the *Volunteer Trail Guide Manual* (VTGM), and hike trails during personal free time. Guides-in-training are encouraged to shadow other volunteer guides at least two times before leading groups on their own.

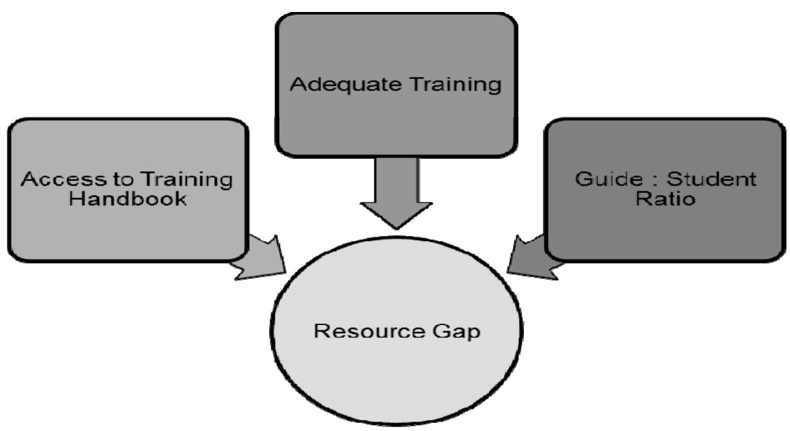
Analysis

Performance Analysis

The importance of a good analysis cannot be overstated when teaching or conducting instructional design. Dick, Carey, and Carey (2008:15) noted that identifying the instructional goal is the most critical event in the entire process. Using a performance technology approach, designers do not bring preconceived notions of what to include in an instructional product. In fact, the designer should acknowledge that the problem might not be instructional at all. Based upon a needs analysis, defined as a discrepancy or gap between the desired state of affairs and the present state of affairs (Burton & Merrill, 1991:18), designers can determine what gaps exist and which gaps to address with training (Gagné, Wager, Golas, & Keller, 2004:20-21).

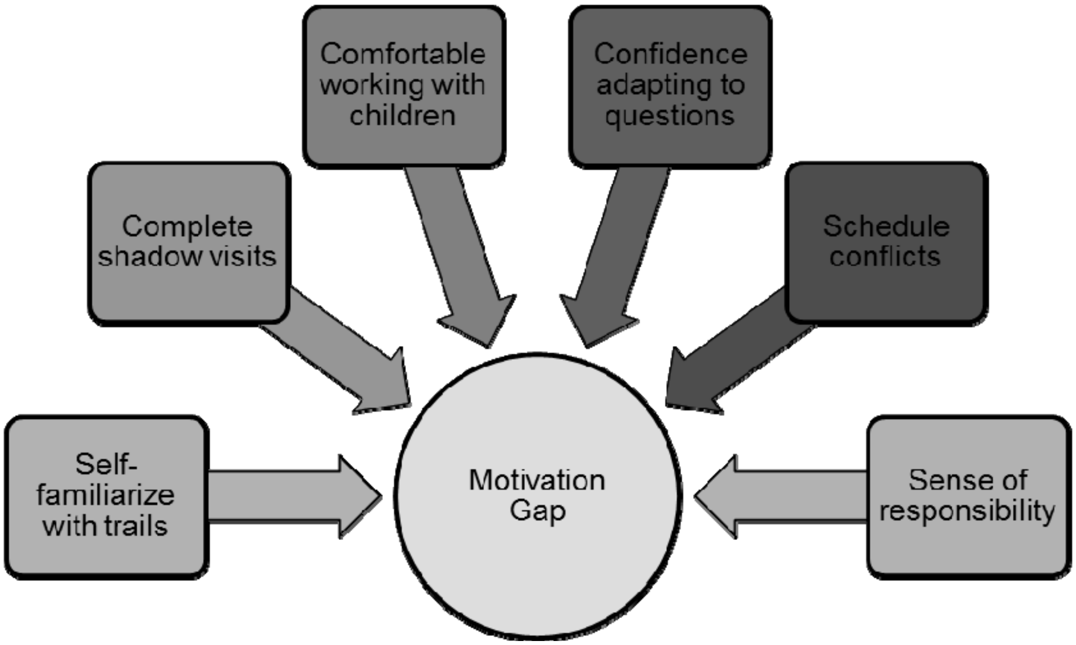
In terms of instructional needs at the nature center, the project team found that training materials were last updated approximately five years prior to undertaking the project. Further, parents/teachers of children attending the center and the lead naturalist expressed concerns with the knowledge and skills exhibited by volunteers. As a result of this initial inquiry, the project team consulted eight volunteers and seven parents/teachers to investigate the concerns. Additionally, the team conducted observations of the volunteers, evaluated feedback from a third-party observer, and interviewed the center's Head Naturalist. The team classified the results of this assessment into three broad categories, Resource, Motivation, and Knowledge gaps. With respect to the resource gap, illustrated in Figure 1, the project team made three recommendations, including lowering the guide-to-student ratio in order to enhance volunteers' ability to interact with visitors and decrease the feeling of being overwhelmed, increase the frequency of training programs, and provide access to an updated training handbook.

Figure 1. Performance assessment: resource gap



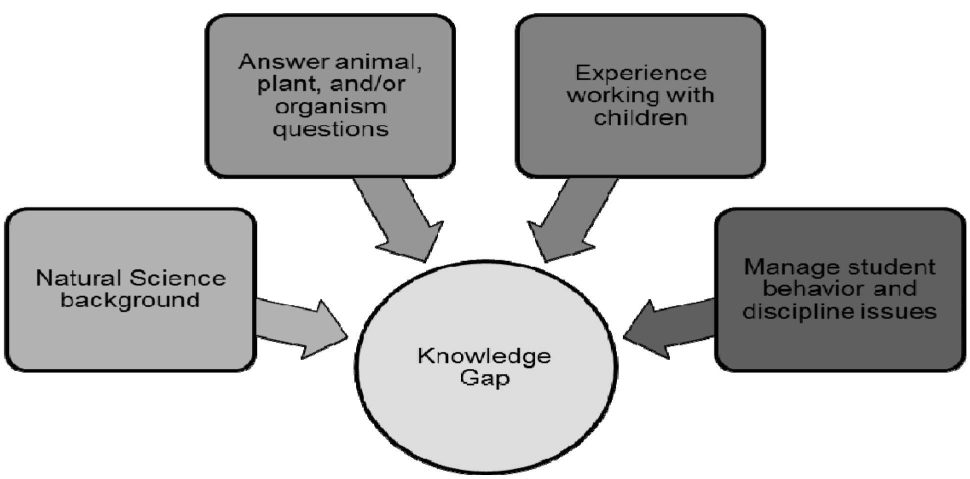
Six elements were classified in the motivation gap and included issues such as confidence and training completion, as illustrated in Figure 2. Though the observed motivation gap issues are not directly addressed with training, the project team kept these factors in mind throughout the duration of the project, making suggestions to the stakeholders when appropriate.

Figure 2. Performance assessment: motivation gap



The knowledge gap was made up of four major elements that are illustrated in Figure 3. The project team recommended redesigning the volunteer training program to address the identified knowledge gap and producing a new VTGM.

Figure 3. Performance assessment: knowledge gap

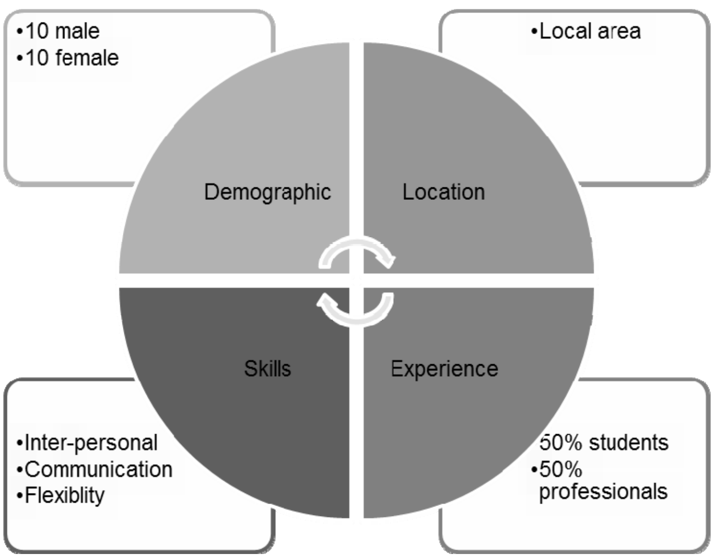


The project team continuously referred to the findings of this analysis throughout the duration of the project.

Learner Analysis
The next step in the analysis phase involved assessing the existing knowledge and skills of the volunteers since they were the learners for the instructional intervention. It is important for the designers to consider the characteristics of learners, contexts in which the instruction will occur, and the context in which the skills are eventually used (Dick et al., 2008:91). Further, learners have certain qualities that relate to instruction. Characteristics related to instructional design are specifically those that affect information processing (Gagné et al., 2004:106-107). In an overview of instructional design models, Richey et al. (2010:78) refer to a number of theorists, including Bloom (1976) and Carroll (1963), to illustrate the importance of examining learners to consider needs, interests, and level of development as they relate to cognitive and affective behavior. Using as much detail as possible to craft a learner profile makes designing and developing the planned instruction an easier task later in the process.

The nature center training focused on the volunteers, who range in age from 20 to 70 years old. Most volunteers have worked with students or led instruction in some capacity. A survey of the volunteers revealed that they have experience working with students ranging from ages 4 to 15. While about 50% of the volunteers are college graduate students, the remaining half actively work in the fields of education, journalism, environmental advocacy, and restaurant management. Most volunteers, whether amateur naturalists or graduate students in a scientific field, have a basic knowledge base in environmental science and/or natural history. A general profile of learners appears in Figure 4.

Figure 4. General learner analysis



The project team's first important discovery during this analysis was that the age range of the learners is quite wide. Second, the experience level of the volunteers is extremely varied. Considering these two factors, the project team felt it important to focus on the volunteers' skills for use in designing the instruction. Having a better understanding of the performance gap and learners, the project team could move forward with prescribing a suitable training program.

Training Purpose
Designers must consider various components of the learning environment when determining instructional goals. Knowing the learners' characteristics and having an identified knowledge gap is not enough information to develop quality instructional goals. Generally speaking, Dick et al. (2008:26) prescribe three

steps to selecting instructional goals. In the first step, designers should question whether or not developing the instruction would address the identified instructional problem. Second, the project stakeholders must find the goals acceptable. Third, the designers must consider the availability of resources in order to develop and implement any prescribed instruction. Keeping these three guidelines in mind, the project team recommended the following training purpose: "to provide participants with the knowledge and skills necessary to create positive outdoor learning experiences on the nature center trails." In order to ensure that the purpose of the training program is met, four instructional goals for volunteers were established.

1. Define the role of environmental science in supplementing student education at the SCNC
2. Identify best practices for working with students of different age groups
3. Manage student behavior based on group dynamics
4. Distinguish between types of living and nonliving components commonly found at the SCNC

The goal statements were drafted using guidance from Bloom's Taxonomy of Instructional Objectives (1956). This decision was made because instructional goals are intended to be clear statements of behavior that learners should demonstrate at the conclusion of instruction (Dick et al., 2008:24-25). Given that the learner analysis showed a weak understanding in natural sciences, the project decided to include an instructional goal aimed at mastering simple, concrete concepts. To address this issue, the first instructional goal related to environmental science was written at the knowledge level of cognitive domain, which prescribes knowledge of specifics, ways of dealing with specifics, and universals of a field (Krathwohl, 2002:212-213). Looking to address the knowledge gap related to working with children, the designers drafted a slightly more complex instructional goal. As such, the statement was written at the comprehension level to encourage translation and interpretation (Krathwohl, 2002:213). The next instructional goal was based upon the learners' perceived deficit in knowledge and practice regarding managing student behavior and discipline issues. Volunteers expressed frustration when working with the students in person, and the project team agreed that an effective solution allowed practicing concepts related to managing behavior. Last, the project team sought to address the knowledge gap related to living and nonliving components of the nature center. This complex gap required a higher element of knowledge transfer and application related to analyzing elements, relationships, and organizational principles, placing it at the analysis level (Krathwohl, 2002:213). Therefore, all four instructional goals represent a progression of cognitive development that increases in complexity and requirement after achieving each previous goal.

In order to carry out these instructional goals, the instructional design team recommended expanding the existing volunteer training program to include an online component. The online materials would focus on group management techniques and best practices for working with children. These materials would include videos, tutorials, and vignette scenarios to present and reinforce the concepts. The face-to-face session would focus on supporting environmental science programs at local schools; familiarization with the nature center resources, including trails and facilities; and identification of local flora and fauna. Further recommendations included developing special topic seminars offered at periodic intervals throughout the year. These training recommendations were detailed to the stakeholders as two separate options for consideration.

Evaluating the Analysis

At the conclusion of the analysis phase, the project team drafted an analysis summary for the stakeholders. This document contained narrative details regarding the overall process, performance gap, learner analysis, training purpose, and resource analysis. Additionally, the two recommended training options were presented with cost breakdowns and estimated timelines. Though the project team noted that the recommended training programs did not require any additional management or technology investments, the stakeholders opted not to support the development of an online component or the supplemental videos. Instead, they requested a third action that would effectively re-design the training within the existing constraints and materials.

Upon receiving approval from the stakeholders to proceed with the design phase, the project team felt it important to evaluate the analysis phase and adjust the process plan accordingly. Similar to Nieveen's (1997) CASCADE model, the project team wanted to emphasize formative evaluation at each phase in the project process to achieve a satisfactory level of quality. The designers felt that the stakeholders' decision to request a previously unproposed option was due to their lack of adequate consideration of the second and third steps as prescribed by Dick et al. (2008:26) and discussed earlier. The stakeholders did not agree that the project could be completed on time if selecting one of the proposed options. After reaching a compromise with the stakeholders, the project team readjusted the project timeline and cost estimates accordingly and was able to proceed to the design phase.

Design

Designing for instruction requires more than considering the purpose of the instruction. Rather than beginning design by asking about learning content, designers must focus on what students will be doing after they have received instruction (Gagné et al., 2004:172). In order to help organize the design process, a designer can begin with a task analysis or inventory through which they clarify outcomes of instruction and arrange or rearrange components into an instructional sequence. The end result creates a blueprint that helps designers make sure that important parts of the lesson are not ignored and components support one another (Jonassen, Tessmer, & Hannum, 1999:vii). Once the task analysis has been completed, designers identify instructional strategies and activities to facilitate the prescribed learning.

Based upon the previously identified instructional goals, the project team created a task inventory. This inventory included all four instructional goals, relevant tasks, subtasks, and prerequisite skills and knowledge. For the purpose of this discussion, the analysis for the first instructional goal appears in Table 1. After compiling a complete task inventory, the project team drafted instructional objectives for each of the tasks and subtasks. Mager's (1997) three-component model for writing objective statements was used for this activity. The first element of the objective describes the skill or behavior indicated in the task analysis and what is expected of the learner. The second component addresses the conditions under which the learner will carry out the task. The final segment describes the criteria that are used to evaluate the learner. For example, the objective for Task 1.3 is illustrated in Table 2.

Table 1. Task inventory sample

Instructional Goal	Task	Subtask	Prerequisite Skills & Knowledge
1. Define the role of environmental science in supplementing student education at the SCNC	1.1. Recognize the interconnection between the [nature center] and school curriculum		

	1.2. Identify the interconnection of all life	1.2.1. List the steps in the water cycle 1.2.2. List the steps in the carbon cycle	Define biosphere Define atmosphere
	1.3. Describe conservation techniques	1.3.1. Explain resource allocation	Define ecosystem

Table 2. Performance objective sample

Task	Describe conservation techniques
Condition	from memory
Criterion	that would impact the SCNC

All objectives were written to a specific performance level of Bloom's Taxonomy in an attempt to cover all levels from knowledge to evaluation. As seen in Table 2, the performance objective for task 1.3 was at the *comprehension* level. Furthermore, each objective included a testing method that instructors could use to measure when the objective had been mastered. In the case of Task 1.3, the testing method was, "During group discussion, describe at least one conservation technique that could benefit the SCNC when asked by the instructor." Upon compiling the task inventory and drafting all performance objectives, the designers presented the documentation to the stakeholders for approval.

Evaluating the Design

Before moving on to development, the designers reviewed the design process and products created as a means of continuing the formative evaluation. From the perspective of the experienced designers, creating a task analysis aligned with a table of performance objectives similar to that displayed in Table 2 effectively created a line of sight. As Branch (2009:60) indicated, line of sight is a "practical approach for maintaining an alignment between needs, purpose, goals, objectives, strategies, and assessments throughout the ADDIE process." In keeping with the blueprint concept, working through the design process with line of sight in mind helped prevent overlooking any important details and identified missing or duplicate components. Of all the phases completed during the process, the project team felt that design was the most helpful in terms of practical experience.

Development

Assuming that the purpose of instruction is to support the process of learning, designers base instructional materials on learning processes and engaging the learner. Thus, components of instructional materials and procedures included in instructional strategies are aimed at fostering the desired learning outcomes (Dick et al., 2008:165). Within the instructional strategy, designers should note that instruction is typically made up of a series of events external to the learner intended to help learners achieve a learning objective (Gagné et al., 2004:195). The precise manner in which these events occur generally varies by design, but has been summarized as *Gagné's Nine Events of Instruction*. These events are intended to stimulate information processing and foster the learning process. Table 3 illustrates the strategies as related to the nine events of instruction developed by the project team for Task 1.3. These strategies incorporate the needs identified in the learner analysis as well as performance expectations from the stakeholders.

Table 3. Strategies for Task 1.3

Event	Strategy
Gain Attention	Pass around images of the Everglades and regions of the Amazon Rain Forest before man affected them. Ask the group to identify each image. If the group is unable to guess the answer, provide trivia hints accordingly. Once the image has been identified, distribute the current image and explain how a lack of conservation principles and laws resulted in their current state(s).
Objective	Following the image activity, the instructor's prompting statement and subsequent questioning leads into an explanation of the objective.
Prior Knowledge	Instructor leads group into nature trails and to identify examples of the carbon and water cycles.
Content	Referring to the VTGM, instructor explains how the SCNC came to hold its current status in Athens-Clarke County (ACC) and outlines the conservation techniques that maintain and preserve the park.
Guided Practice	Using the content as a platform, instructor refers to other park facilities and asks students to name conservation techniques that might be in place in the other locations.
Ind. Practice	Refer to VTGM, Nature Center facilities, personal experience, and online resources. Based upon the ecosystem selected, they are to list at least three conservation techniques that could be in use at the specified location.
Feedback	During both guided and independent practice, instructor reminds students of techniques used at the SCNC. Upon immediate response of questioning, instructor should confirm the answer or provide prompting of further responses if necessary.
Assessment	Instructor individually asks each student to name a conservation technique used at the SCNC.
Closure	Instructor asks the group to describe a scenario that could happen to the SCNC if conservation techniques are not followed.

Continuing the development process, the project team drafted a full instructional strategy as recommended by Dick et al. (2008:165) to support the training program. This strategy included identifying all media to address visual, auditory, and kinesthetic needs of the learners. Together, the described elements herein were presented to the stakeholders in a development summary for their approval before moving on to implementation.

Evaluating the Development

The project team felt that development was the most difficult and challenging of all the phases in the ADDIE process. Development required substantially more effort than design in that each objective was scrutinized for the instructional strategy. As Gagné et al. (2004:194) noted, not all events of instruction are appropriate for every lesson. Therefore, the design team evaluated each objective within the context of the events of instruction and drafted a corresponding strategy. Line of sight was again helpful to the team as they created documentation to ensure flow and inclusion of every component from information content to media selection. In the end, the attention to detail proved beneficial as the stakeholders approved the development summary and authorized the team to move forward with implementation.

Implementation

The implementation phase of instructional design varies among instructional design models, but generally encompasses the same common tasks. Richey et al. (2010:21) note that during implementation, instructional materials are developed and procedures for installing, maintaining, and periodically repairing the instructional program are specified. As requested, the project team drafted a new VTGM for the volunteers as well as an instructor's guide for personnel conducting the semiannual face-to-face training. The new VTGM contained updated graphics and illustrations to replace outdated or ambiguous images. The document was also expanded to include sections that aligned with the tasks identified in the performance analysis and provide learners with the knowledge they would need to fill the perceived gap. Following Diamond's (1989) model of instructional design, the project team included field testing as part of material production. This task was accomplished by working with select volunteers to evaluate sections in the new manual as they were produced. Additional instructional materials included the development of job aids that condensed portions of the VTGM, such as common animal paw prints and leaf types, onto 3"x 5" cards for use in the field. The aids were created to reinforce higher level learning objectives that related to living and nonliving components at the nature center. The component of implementation included drafting learner and facilitator plans. The learner plan included learner identification, training schedule, notification description, and tracking requirements. The facilitator plan addressed facilitator identification, scheduling train-the-trainer sessions, and preparation instructions. With all materials complete, the stakeholders signed off on the implementation phase.

Evaluating the Implementation

Evaluation of the implementation process occurred simultaneously with production. The designers felt that their comprehensive approach to the previous phases of the process made the implementation phase easier to complete and created structured guidelines to use in updating existing materials. As such, the designers found that they had incidentally developed a checklist of corrections and new documentation for creation. By using the Diamond Model recommendation of field testing during production, the designers were able to immediately adjust the content to fit the needs of the learners. Further, it was through this process that the idea to create the job aids came about. Ultimately, the approach taken by the project team created a high quality product that met with stakeholders' expectations.

Evaluation & Conclusions

The final phase of any process is that of evaluation. Every designer wants assurance that his or her instructional product is valuable (Gagné et al., 2004:346). It follows then that systematic, summative evaluation is the means by which we find assurance. In the case of the nature center training program, the project team provided both level 1 and level 2 evaluation tools. The level 1 instrument was developed to capture learner's reaction to the newly improved training, and the level 2 instrument was developed to measure the change in performance of the volunteer guides (D. L. Kirkpatrick & J. D. Kirkpatrick, 2006). Though the project team would not remain under contract with the nature center to perform the evaluation phase of the project, the stakeholders agreed to use the instruments developed and report the results after one year of implementation. At the time of this paper, the nature center reported to the project leader that they were extremely satisfied with the new training program and had seen a significant improvement in the performance of their volunteers.

Returning to the research questions posed by this case study, it is clear that the project team did follow the five phases of ADDIE as prescribed by the literature. Further, as explained within each section, various components of other instructional design models were considered and implemented as necessary. Lastly, the project team encountered a variety of challenges that are often experienced by even the most seasoned instructional designer, such as the compromise with stakeholders on the final training program. From the perspective of the two experienced designers, the project served as an excellent reinforcement of the literature and theories related to instructional design. In conclusion, much can be said about the vast number of instructional models in existence; however, following the basic ADDIE process remains tantamount in providing a foundation the next generation of instructional designers.

References

Barson, J. 1967. Instructional systems development: A demonstration and evaluation project: Final report. East Lansing, MI.

Bloom, B. S. 1956. Taxonomy of educational objectives: Handbook I. New York: David McKay Co, Inc.

Bloom, B. S. 1976. Human characteristics and school learning. New York: McGraw-Hill.

Branch, R. M. 2009. Instructional Design: The ADDIE Approach. New York: Springer.

Burton, J. K., & Merrill, P. F. 1991. Needs assessment: Goals, needs, and priorities. In L. J. Briggs (Ed.), Instructional design: Principles and applications. Englewood Cliffs, NJ: Educational Technology Publications.

Carroll, J. 1963. A model of school learning. The Teachers College Record, 64(8): 723–723. Teachers College Record.

Diamond, R. M. 1989. Designing and Improving Courses and Curricula in Higher Education: A Systematic Approach. San Francisco, CA: Jossey-Bass Inc., Publishers.

Dick, W., Carey, L., & Carey, J. O. 2008. The Systematic Design of Instruction (7th ed., Vol. 5). Boston: Allyn & Bacon.

Gagné, R. M., Wager, W. W., Golas, K. C., & Keller, J. M. 2004. Principles of Instructional Design. Belmont, CA.

Gustafson, K. L., & Branch, R. M. 1997. Revisioning models of instructional development. Technology Research and Development, 45(3): 73-89.

Gustafson, K. L., & Branch, R. M. 2002. Survey of Instructional Development Models (4th ed.). Syracuse, NY: ERIC Clearinghouse on Information & Technology.

Jonassen, D. H., Tessmer, M., & Hannum, W. H. 1999. Task Analysis Methods for Instructional Design. Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.

Kirkpatrick, D. L., & Kirkpatrick, J. D. 2006. Evaluating Training Programs: The Four Levels (3rd ed.). San Francisco, CA: Berrett-Koehler Publishers, Inc.

Krathwohl, D. 2002. A revision of Bloom's taxonomy. Theory into Practice, 41(4): 212-218.

Mager, R. F. 1997. Preparing Instructional Objectives: A Critical Tool in the Development of Effective Instruction. Atlanta, GA: The Center for Effective Performance, Inc.

Magliaro, S. G., & Shambaugh, N. 2006. Student models of instructional design. Educational Technology Research and Development, 54(1): 83-106.

Nieveen, N. M. 1997. Computer support for curriculum developers: A study on the potential of computer support in the domain of formative curriculum evaluation. University of Twente, Enschede, The Netherlands.

Reiser, R. A. 2001. A history of instructional design and technology: Part II. Educational Technology Research and Development, 49(2): 57-67.

Richey, R. C., Klein, J. D., & Tracey, M. W. 2010. The instructional design knowledge base: Theory, research, and practice. New York, NY: Routledge.

Twelker, P. A., Urbach, F. D., & Buck, J. E. 1972. The systematic development of instruction: An overview and basic guide to the literature. Stanford, CA.

Acknowledgements

The authors would like to recognize the contributions of S. Grigg and S. Griffing as members of the project team.