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# White Paper

# Understanding ADDIE: A foundation for designing instruction

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# Understanding ADDIE: A foundation for designing instruction

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*Abstract:* One way in which expert instructional designers distinguish themselves is through their ability to work within a rigorous methodology that ensures high-quality instructional deliverables. In this paper, I describe a basic instructional design methodology called ADDIE, an acronym for analysis, design, development, implementation, and evaluation. ADDIE is the framework that has inspired dozens of more specific instructional systems development (ISD) models. In addition to describing the activities and deliverables associated with each element of ADDIE, I share my own suggestions for optimizing the process.

## Introduction

In the last few decades, literally dozens of instructional systems development (ISD) models have emerged, each promoting certain qualities and each claiming superiority in certain domains (Gustafson, 1991; Gustafson & Branch, 2002). Most of these models were spawned from the classic ADDIE blueprint (Figure 1). ADDIE is an acronym for Analysis, Design, Development, Implementation, and Evaluation. Having a strong fundamental understanding of ADDIE will heighten the reader's appreciation for the nuances of the various ISD models as well as help the reader to begin forming her *own* ISD model. While it is important that the reader be able to apply the various off-the-shelf ISD models, it is even more critical that the reader be able to develop appropriate design processes to fit the individual circumstances of a particular instructional design initiative. My hope is that after reading this paper, the reader will start to build her *own* ISD model, one that she can modify and apply to fit her individual projects. In this paper, I describe the basic elements of ADDIE, the activities involved, the deliverables, the purpose of each, and how they inter-relate.

The ADDIE Model

Most ISD models contain some combination of analysis, design, development, implementation, and evaluation elements. They vary from one another, however, in the level of detail, the sequence of elements, and the form taken by each element. The following is a description of ADDIE.

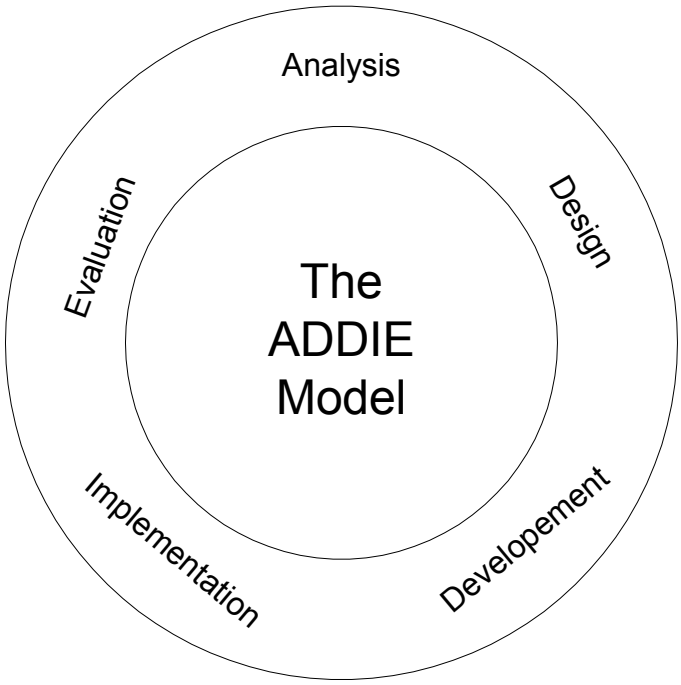


*Figure 1*. A depiction of the ADDIE model

## *Analysis Phase*

Training can, and often does, fail to address intended outcomes when those outcomes are not correctly identified and clearly specified before making instructional design decisions. While good front-end analysis is no guarantee of success, poor analysis practically guarantees failure. Whether documented through an analysis report, such as a needs assessment, or conducted informally, good instructional designers (IDers) strive to understand the drivers behind the learning needed and work to visualize the learning outcomes that need to be achieved in order to address that learning need. Thorough analysis is the foundation on which effective solutions are built, regardless of the setting. There are two general types of front-end analysis that IDers may perform: instructional analysis and performance analysis.

### *Instructional Analysis*

The most common type of front-end analysis conducted by IDers in the field is instructional analysis. Instructional analysis is inclusive of training needs analysis and task analysis (Zemke & Kramlinger, 1982) as well as audience, content, and context analysis. Instructional analysis lays the groundwork for good design by answering the following questions:

- What learner and stakeholder needs should the instruction satisfy?
- What physical and/or mental tasks should the learner be able to perform after completing the instruction?
- In what context will these tasks typically be performed?
- What changes in attitude, if any, are sought?

- What are the demographic characteristics of the audience for this instruction?
- What are the cognitive style and learning preferences of the audience?

Instructional analysis yields a set of specifications for design. These are typically documented in some type of training needs assessment report. Note that when instructional analysis is performed, it is taken for granted that a learning need exists and that instruction *will* be developed to address that need. However, this is not always the case, is it? There are times when training should *not* be developed.

*Performance Analysis.*

Those in the human performance technology (HPT) field argue that *performance* analysis should take place *before* making the decision to develop instruction, i.e., before instructional analysis takes place. Performance analysis involves documenting and comparing actual performance with optimal performance. HPT proponents argue that most performance problems are not related to skill gaps, so training is often not the right solution. Gilbert's (1978) Behavior Engineering Model posits that most performance gaps result from organizational barriers, not from issues pertaining to individual workers. In a survey of managers, Rothwell (1996) found that the most commonly occurring performance problems were related to unclear performance goals, ineffective workflows, poorly conceived incentive systems, and lack of documentation of processes. Training only addresses skill deficiencies. Rothwell (1996) suggests that most performance gaps can be addressed by clarifying goals, by redesigning workflows, by aligning incentive systems with desired performance outcomes, and by providing job aids. Moller and his

colleagues (Moller, Benscoter, & Rohrer-Murphy, 2000; Prestera & Moller, 2001) demonstrate how these HPT solutions can be applied to educational settings.

Skill deficiencies are rarely the root cause of performance gaps. Even when skill deficiencies exist, training alone is rarely the answer to performance issues. All of this suggests that front-end analysis is key to making good decisions about whether or not to train. Gilbert (1978) argues that the potential benefit of training, or any other intervention, should be at least 1.5 times greater than the cost of training in order for it to be a worthwhile endeavor. Conducting a performance analysis can save time and resources, as well as focus improvement efforts on solutions that have the greatest impact on performance. Performance analysis can answer some or all of the following questions:

- What does optimal performance look like?
- What does the current performance look like?
- What is the performance gap? What are the gap's root causes?
- Does fixing the problem justify the cost and effort?
- What performance improvement solutions will best address the gap?

While these are questions that certainly could be addressed in a training needs assessment, things like workflow analysis, root cause analysis, and cost-benefit analysis are often not included. There is a fundamental difference between a training needs assessment and a performance analysis: the former assumes that training is needed and tries to assess what needs to be trained, while the latter does not assume anything and instead tries to assess if there is a significant performance gap. If there is a performance

gap, training is only one of many different performance improvement interventions that is available to the HPT professional.

The output of performance analysis is typically some form of report in which performance optimals and actuals are documented, gaps are identified, costs and benefits are estimated, and performance improvement interventions are recommended. While some educational researchers promote the inclusion of performance analysis in ADDIE's front-end analysis (Zemke & Kramlinger, 1982), seeing learning and performance as inextricably linked, some purists feel that IDers should remain focused on resolving instructional, not performance, problems (Merrill, 1996). So, on the one hand, performance analysis could be seen as part of ADDIE's analysis process, or it could be seen as a separate process that takes place before ADDIE. In any case, regardless of who performs it, performance analysis should take place prior to instructional analysis.

*Design Phase*

The design phase, as the name implies, is the phase in which design decisions are made. This is when IDers apply instructional theory and proven strategies to create learning experiences that are "efficient, effective, and appealing" (Merrill, Drake, Lacy, & Pratt, 1996). At a minimum, the following questions should be addressed:

- Given our analysis of the performance and learning needs, what is the most effective and efficient strategy? (e.g., coaching/mentoring, reading assignment, tutorial, drill & practice, guided discussion, discovery learning, simulation, scavenger hunt, demonstration, war stories, problem-based learning, and a host of other instructional strategies)
- How will we assess the learning outcomes? (e.g., anecdotally through observation or systematically through testing and surveying)
- Who will facilitate learning? (e.g., instructor in one-on-one coaching or in classroom environments, mentorship through on-the-job training, peer learning through live or online discussions, or the individual through independent self-paced learning)
- What learning technologies should be employed? (e.g., chalkboard, flipcharts, handouts, PowerPoint slides, interactive web pages, computer-based instruction, or 3D models)
- How will learners interact with the content, context, instructor, and other learners during the process?
- What are the topics or key messages being communicated and how are those sequenced for the learner? What level of detail is appropriate?

*Design Documents*

Design documents embody the transition from analysis to design, from evaluating alternatives to recommending a specific course of action. High-level design decisions, such as overall strategy, sequence, and content structure, are typically documented in a *design strategy document (DSD)*, while more tactical decisions are identified in more detailed *treatment plans*. A treatment plan is similar to a lesson plan (a design document used by teachers in educational settings). In multimedia settings, an IDer might partner with a graphic artist to write a treatment plan for the look and feel of a web-based training (WBT) course. This plan might include the visual theme of the course (its *motif*), the colors being used (its *palette*), the basic screen design (the *template*), the layout of buttons (its *interface*), and other elements that influence the course's look and feel. Design documents contain some or all of the following:

- **Specifications and assumptions** - recap of front-end analysis findings, resource constraints, and technical constraints
- **Instructional goals** and subordinate learning objectives
- **Instructional strategies** and tactics used to address each learning objective – often this revolves around interactivity issues of practice and feedback
- **Scope of instruction** – subject-matter covered, duration of course, and number of learning events
- **Content structure** – topic outlines, behavioral algorithms (workflows), summary of task and content analysis

- **Learning context** – description of the learning environment. With CBTs/WBTs, this would include a description and sample of the course's look and feel, interface, and navigation

Using the design documents as the foundation, instructional designers in multimedia settings also create *storyboards* and *scripts* to detail the design of each individual frame and computer interaction. These design documents are the architect's blueprints and will be used throughout the development process. The level of detail and complexity of the design documents vary. A teacher who designs and develops her own classroom materials will require much less documentation (i.e., a lesson plan) than an IDer who is working with a whole team of programmers, graphic artists, animators, videographers, subject-matter experts, and other specialists with whom she needs to communicate.

*What do instructional designers design?*

One might answer this question simply with "instructional designers design instruction." Well, what is instruction? Is instruction nothing more than the presentation of facts, concepts, rules, etc. that are contained in our instructional media (slides, handouts, videos, WBT modules, etc.)? I argue that what instructional designers design actually consists of interactions. IDers design interactions by manipulating the 6 instructional elements, namely: (1) the learner, (2) the performance outcome, (3) the content, (4) the context, (5) the instructor, and (6) the other learners. This model (depicted in Figure 2) is inspired by similar interaction models developed by Michael

Moore (Moore & Kearsley, 1996), Joseph Novak (Novak, 1998), and Les Moller (Moller, Prestera, Harvey, Downs-Keller, & McCausland, 2002).

I further argue that an instructional designer's primary purpose is to create a vision of the interactions that are necessary among these elements to ensure that learners leave training with the skills they need. Everything else contained in the ADDIE Model, all of the activities and deliverables, simply facilitate the manifestation of this vision.

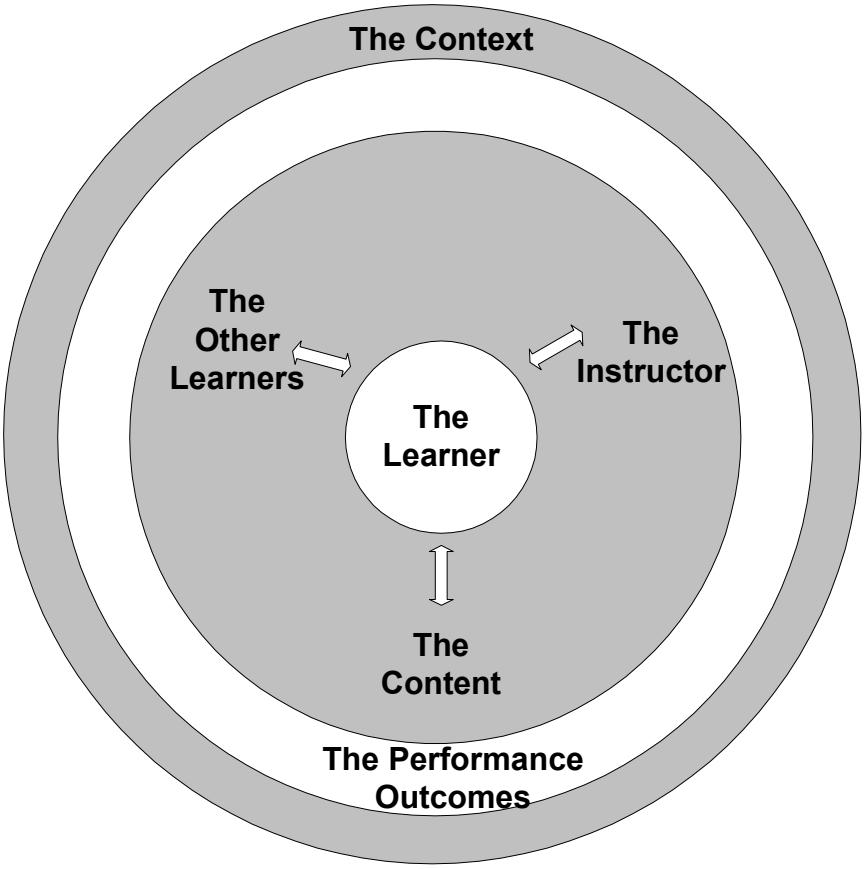


*Figure 2*. Depiction of the Six Instructional Elements. IDers can manipulate them to form countless instructional strategies

*Assessment Items*

An often-overlooked step in the design phase is to develop the assessment items (items are test questions). Dick and Carey (1990) posit that assessment items should be developed before the instruction is designed. This may seem counter-intuitive. How can you write a test if you do not know what the content will be? This is a legitimate concern, however, it stems from a mistaken belief that training should be content-driven, i.e., that instructional design decisions should be made based primarily on the nature, volume, and form of the content. Figure 3 depicts the process typically followed by novices in developing content-driven instruction and compares that with a performance-driven design process.

Content often consists of tasks and facts. Tasks and facts are passive and abstract, so they require action (behavior) or thought (cognition), respectively, to be brought to life, i.e., to be changed into performance or knowledge. Let us consider a content-driven objective: "After reading this essay, the reader will know the ADDIE model." Is that observable behavior? No. I cannot observe the reader "knowing." The objective assumes that you will learn a collection of facts pertaining to ADDIE. How would I assess this learning outcome? Test the reader on the facts? What facts? This objective is rather vague and so it provides little guidance in determining what content to include and what not to include. In the face of uncertainty, the IDer will typically err on the side of including more information than is truly needed. For these reasons, content-driven training is generally unfocused, passive, and typically does not contain the right type or volume of content. Also, when assessment items are derived from content, they usually

lack relevance in the real-world, because they are based on abstract facts rather than on real-life performance needs.

If the learning objectives are written correctly, they should be action-oriented, in the form of observable behaviors (Zemke & Kramlinger, 1982). Consider the following objective, "After reading this essay, the reader should be able to create a concept map that reflects her own ISD model." Is *creating a concept map* an observable behavior? Yes. Based on this objective, the assessment task is quite clear. Also, it is much clearer to me, as the IDer, what I must do to help the reader achieve that objective. I have a good grasp of what to include and what not to include, how much detail to provide, what kinds of examples to include… in short, because I know what the assessment outcome is, I am better prepared to design the instruction. If I now developed the actual assessment instrument and designed the concept mapping task, then my understanding of the learning outcome would be even clearer. How much more efficient and effective would this clarity make my design of the instruction itself?

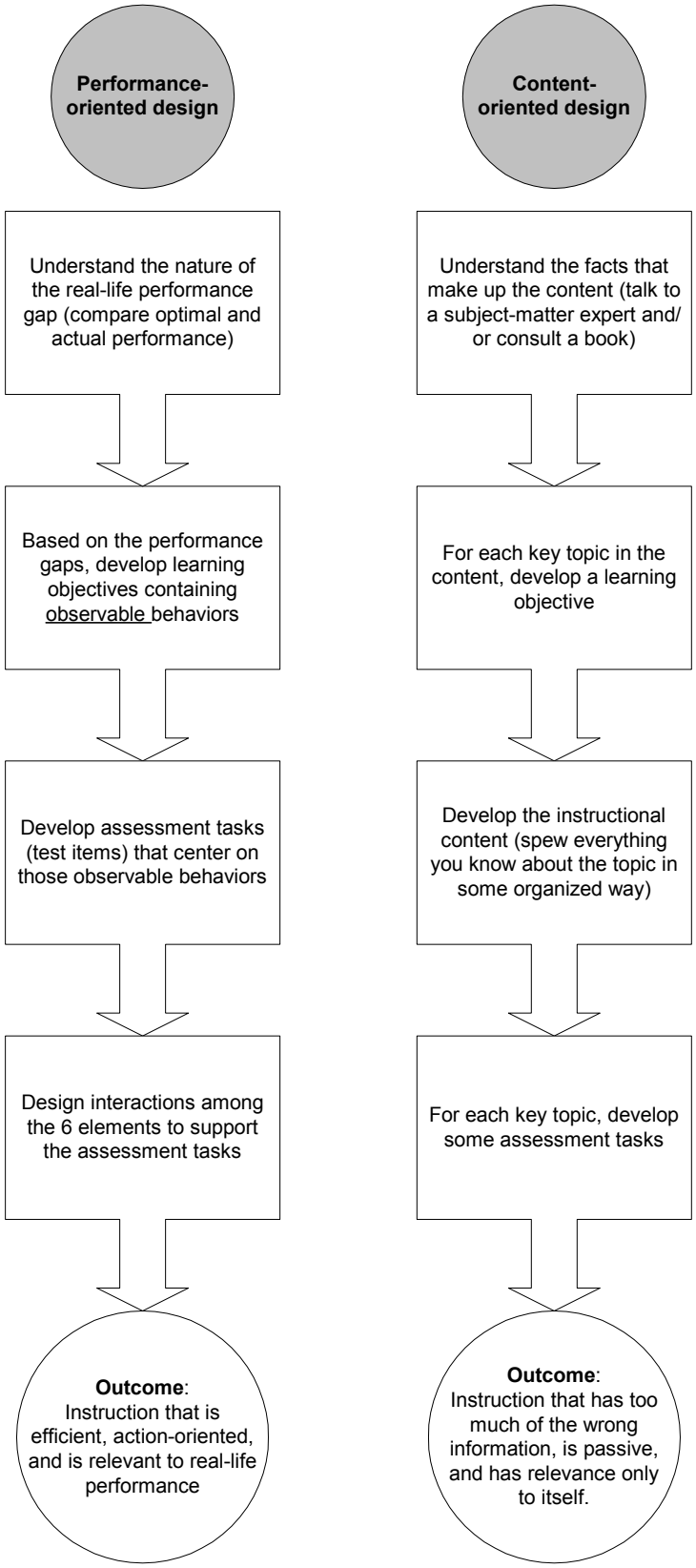


*Figure 3*. Diagram contrasting performance-oriented design with content-oriented design

*Alternatives to "objective" assessment items*

But you say, 'test items cannot accurately capture real-life performance.' Who says that test items always need to involve multiple-choice questions or other abstract types of tasks, so-called "objective" test items? Test items *can* be authentic… in fact, the more authentically the assessment tasks replicate real-life conditions, the more valid they are and the more instructionally useful they are (Hoffman, 1962). Even when learners are not being tested per se, authentic assessment items can be used as instructional activities that enable learners to practice and explore. In an ideal situation, there is very little difference among real-life performance, assessment items, and practice items.

Another alternative to traditional multiple-choice, true-false, and fill-in-the-blank tests is concept mapping (Novak & Gowin, 1984). With concept maps, learners organize concepts hierarchically, then articulate principles through connecting phrases. Through the use of concept mapping and other diagramming tasks, it is possible to improve recall as well as high-level understanding of the structure of knowledge. Structural knowledge improves the learner's ability to analyze problems and generate more creative solutions (Prestera & Clariana, 2003). Concept mapping and diagramming in general are excellent assessment tools that can help the IDer communicate and assess complex, high-level knowledge. Assessment items can and should replicate the real-life cognitive and behavioral demands of the job: the IDer's challenge is to develop authentic assessments that truly capture the complexity of knowledge and skills.

To summarize, the design phase in ADDIE is where one takes the analysis generated in the previous phase, identifies the performance outcomes, crystallizes one's understanding of those outcomes by developing the assessment criteria, and then designs

the interactions that will support the learner through the process of converting facts to knowledge and tasks to action, i.e., learning. Instructional design should be performance-driven rather than content-driven, and IDers should be most concerned with visualizing the interactions in the learning process rather than visualizing the media. IDers should also make use of authentic assessment tasks and more advanced cognitive tools that better capture structural knowledge and high-level thinking skills.

### *Development Phase*

In the development phase, the instructional media are produced. Sometimes a lone instructor or IDer produces the materials. With more complex projects, the instructional development can include teams of IDers, writers, technical writers, instructors, computer programmers or web developers, graphic artists, animators, movie producers, audio engineers, copy editors, and many others. In multimedia instruction, audio and/or video may need to be recorded, edited, and digitized; graphics and animations may need to be generated; and lines of programming code may need to be written/authored. During the production phase of multimedia projects, the IDer often acts as a producer and head writer, coordinating the production of course content. Voice-over narration and/or video scripts need to be prepared; the graphic artists and animators need their graphics lists, and the programmers/developers need their programming specifications. Considerable quality assurance testing, what Dick and Carey (1990) call *formative* evaluation, takes place during the development phase in preparation for implementation. This can involve external testers and quality assurance specialists.

### *Implementation Phase*

Once the instruction has been developed, it is implemented in the learning setting with real learners. It is a good idea to pilot the training, at the very least as a final transition between the development phase and implementation. Proponents of rapid prototyping, an iterative methodology rooted in computer science, promote the practice of developing instruction first and pilot testing early and often during the instructional development process (Thiagarajan, 1999). Through frequent feedback loops, the final

form of the instruction emerges. These iterative models are prevalent in corporate training, particularly in organizations that design web-based and computer-based instruction. One lesson to take away from rapid prototyping is that even after investing many hours of instructional analysis and planning, our first designs, much like first drafts, are not likely to be our best work. Iterative design models suggest that by (1) quickly moving into the development phase, (2) engaging in develop-evaluate feedback cycles with end users and stakeholders, and (3) trusting in the emergent nature of design, it is possible to develop highly complex instructional programs in a fast, effective, and collaborative manner. While this methodology may not be appropriate for all instructional development projects, it presents an interesting contrast to the linear ISD models that currently dominate our field.

*The Logistics of Instruction*

During the implementation phase, a host of logistical issues will need to be resolved. For instructor-led training (ILT), such issues could include student registration, hotel reservations, train the trainer (T3) programs, arranging refreshments, securing facilities, room configurations, equipment, classroom supplies, and a host of other factors. For technology-based training (TBT), implementation factors center on providing learners with access to the course, securing enough server capacity to accommodate demand, establishing online registration and course management protocols, ensuring that relevant data (usage time, scores, completion status, etc.) are being tracked correctly, resolving hardware, software, operating system, and browser conflicts, and managing a host of other technical details. In the case of both ILT and TBT, it is

important that implementation risks and factors be identified early in the planning process. Implementation problems often arise from poor planning and a failure to engage in risk management (refer to PMI's Project Management Book of Knowledge, PMBOK, for more on risk management).

### *The Dirty Job of Instructional Maintenance*

Another implementation phase activity that requires considerable planning is maintenance. Who will monitor the evaluation feedback on an ongoing basis and make changes to the instruction when needed? Who will routinely check to make sure that the content is not out-of-date? Who will handle registration, bookings, and all of the other logistical details going forward? Who will manage the database containing attendance records, assessment scores, etc.? In today's "get it done and move on to the next new thing" corporate world, maintenance is easy to forget.

## *Evaluation Phase*

Evaluation, at least in the context of ADDIE, refers to the process of assessing the quality of the instruction that has been developed. Dick and Carey (1990) categorize two types of evaluation: formative and summative evaluation. The former is an ongoing process that *ends* at implementation, while the latter *begins* at implementation and can continue throughout the life span of the training.

After the instruction is implemented, the effectiveness of the course should be assessed through summative evaluation. Kirkpatrick (1998) proposes four levels of evaluation for training:

- Level 1 Reaction – Were the learners satisfied with the instruction?
- Level 2 Learning – Did they learn what they were supposed to learn?
- Level 3 Behavior – Did what was learned in the classroom transfer to the workplace in the form of behavior changes?
- Level 4 Results – Did the behavior change lead to business results?

Most organizations only evaluate training at level 1, reaction, if at all. Often, this consists of "smile sheets," surveys that ask learners to rate their satisfaction with the course. Occasionally, learning (level 2) is measured. Rarer still, some organizations measure how well learning *transferred* to workplace performance (level 3) to find out if learning led to behavior change. Only a small percentage of organizations actually measure changes in organizational performance to determine if the behavior change contributed to business results (level 4). An even more elite group of organizations uses cost-benefit analysis to measure returns on training investment, what Phillips (1996) calls the fifth level of evaluation. The fact that evaluation is so unusual in organizations is unfortunate and is something that our field needs to remedy before managers can truly appreciate training expenses as legitimate performance improvement *investments*.

## *Key Messages*

The following are three key messages to take away from this paper:

1. **Performance, performance, performance -** Only performance matters… start and end by considering the performance gap. Without upfront performance analysis to identify the gap and at least level 3 evaluation at the end to measure post-training performance levels, it is impossible to substantiate the claim that training improves

performance. Developing high-quality training is difficult and expensive, compared to other performance improvement solutions, so it better be worth the cost and effort!

2. **Do not be content-oriented** – Being content-oriented is easy, it is fun, it is even perhaps intuitive, however, it is also shortsighted and can lead to poorly designed instruction. Have the discipline to stay focused on performance outcomes. Writing learning objectives with observable behaviors is a good start. Developing your assessment instruments first and allowing your design to be guided by your assessment also helps you stay focused on performance outcomes. Some complain that this is teaching to the test. In training, there is nothing wrong with teaching to the test, if the test is an authentic representation of the performance task. One could argue that the learning goals of educational institutions are broad, long-term, and often fuzzy, so teaching to the test can be unnecessarily limiting, narrow-minded, and pedantic. However, the main purpose of corporate training is not to educate, it is to improve skills for immediate transfer to workplace performance. Once we accept that distinction, teaching to the test (i.e., performance outcome) makes more and more sense.
3. **Close your eyes and see: visualize the interactions** - Being able to visualize the implementation of the training is one characteristic that distinguishes an experienced IDer from a novice. That visualization should start early in the process and continue throughout. Focus *not* on what the instructional media should look like; rather, focus on the kinds of interactions that learners should have in order to develop their skills and enhance their ability to perform. Visualize the interaction of the six elements.

## Conclusion

The ADDIE Model is *not* an ISD model per se, but it is the basic framework that has inspired countless ISD models. Understanding the 5 general phases of instructional development should help the reader make sense of the ISD models. It should also help the reader to make educated judgments about each one. I submit that no ISD model is perfect for all situations, nor are they intended to be. Understanding the activities and deliverables associated with the phases of ADDIE and learning the characteristics of the various ISD models are excellent first steps. Next, I hope the reader will take the time to develop her own ISD model, one that reflects her own values and beliefs about learning and performance. To aid the reader in that pursuit, I have provided descriptions and examples of ADDIE components, discussed my own assumptions, and shared several diagrams. I hope this essay has started the reader on an interesting path and has provoked some introspection that will lead to better design, better learning, and better performance.

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