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## INSTRUCTIONAL DESIGN AND THE IMPORTANCE OF INSTRUCTIONAL ALIGNMENT

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*This paper highlights the instructional design process followed by the Maricopa Community College faculty in the creation of instructional modules in Digital Visual Literacy. The paper categorizes 10 tasks that an instructional designer, a teacher, or a trainer performs during the design phase of the instructional design process. The importance of alignment between each of these 10 instructional elements is stressed in the paper. Also described are two different design models (top-down model and the matrix model) that were used by the faculty in the design of instructional materials. The matrix model has been found to be more effective in aligning the 10 instructional elements. Also included are survey results on the importance of the instructional design elements and if instructors include these elements in their lesson design in a community college setting.*

As technology advances, ensuring the quality of educational experience continues to increase in importance. In this project, funded by the National Science Foundation, 12 pioneering instructional modules on Digital Visual Literacy (DVL) were developed via a partnership between a community college and a university. The DVL modules were developed, in particular, for the introductory computer science and literacy courses required of students pursuing technical education at community colleges and elsewhere. The DVL modules can be deployed in basic computer literacy courses at the

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community college. These modules include a set of skills that enable students to function in an increasingly digital and visual workplace. These modules are available for anybody to use in computer literacy courses. (The website for download will be provided after the review.)

This paper highlights the instructional design process followed while working with the community college faculty in creation of these modules. The author had the opportunity to work with a number of faculty from the Maricopa community college system to develop instructional modules on Digital Visual Literacy. During this process, the author worked with subject matter experts in information technology and Digital Visual Literacy experts from Brown University to develop the 12 DVL modules.

Instructors are subject matter experts but not necessarily instructional designers. This article highlights the step-by-step process in instructional design used to help the community college faculty design effective instructional modules. Also included are survey results on the benefits of following the instructional design process in a community college setting.

### ***WHAT IS INSTRUCTIONAL DESIGN?***

Instructional design is a system of developing well-structured instructional materials using objectives, related teaching strategies, systematic feedback, and evaluation (Moore & Kearsley, 1996). It can also be defined as the science of creating detailed specifications for the design, development, evaluation, and maintenance of instructional material that facilitates learning and performance.

A number of instructional design models have been designed to guide the users in the instructional design process. The ADDIE process (analysis, design, development, implementation, and evaluation) is a generic instructional design model with a framework that helps users in the creation of instructional material for any type of learning such as print and web based. The model represents a dynamic, flexible guideline for building effective instructional material.

The different phases of the ADDIE process—analysis, design, development, implementation, and evaluation—provide a roadmap for the entire instructional design process. It starts with what one has to learn and ends when we find out if they learned what was needed.

During the analysis phase, the designer develops a clear understanding of the gap that exists between the desired outcomes and the existing knowledge and skills of the learners. Design and development are two

separate and equally important phases in the ADDIE model. The design phase documents instructional goals, specific learning objectives, the instructional material, identifying examples, practice activities and feedback, instructional strategies, media, and assessments.

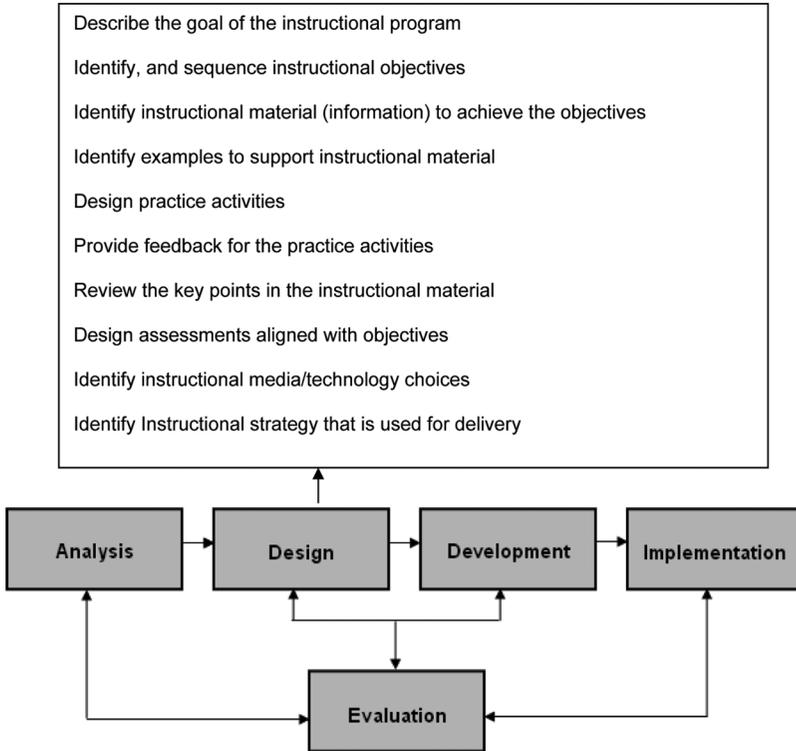
In a lot of cases, the development phase is considered to be the most important of all. Thus, one tends to overlook the design phase and allocate less time to it or even totally skip it and go straight to course development. However, designing the instructional material correctly saves one from a lot of excess development time.

The design phase follows the analysis phase, and information from the analysis phase is translated into a plan for an instructional program. This ensures that we focus all the instruction on critical needs and convey the essential knowledge and skills that people require to perform well.

### ***INSTRUCTIONAL ELEMENTS IN THE DESIGN PHASE***

The design phase includes the identification of goals, objectives, information, examples, practice activities, and review formats. This phase also involves recognizing the instructional strategies that will be employed to achieve the objectives and the media and methods that will be most effective in the delivery of the objectives (Seels & Glasgow, 1998). The designers determine how objectives will be assessed and what forms of assessment will be used. The objectives and assessments should also align and be meaningful (Peterson, 2003). At the end of the instructional design phase, the designer creates an instructional design document that provides a high-level overview of the entire instructional material. This design document might include all or some of the 10 components identified below:

1. Describe the goal(s) of the instructional program.
2. Identify and sequence instructional objectives.
3. Identify instructional material (information) to achieve the objectives.
4. Identify examples to support instructional material.
5. Design practice activities.
6. Provide feedback for the practice activities.
7. Review the key points in the instructional material.
8. Design assessment aligned with objectives.
9. Identify instructional media/technology.
10. Identify Instructional strategies.



**Figure 1. ADDIE process with the design components.**

Below is a brief review of each of these design steps along with a diagrammatic format of the design steps (see Figure 1) within the ADDIE model.

### *Analyze and Describe the Instructional Goal*

Goals are broad, generalized statements about what is to be learned. They are thought of as a target to be reached. The goal is developed based upon the results of a needs assessment. A goal describes an outcome of instruction and does not refer to the instructional process itself. In instructional design, goal analysis is used to identify what the learner should be able to do after mastering the instructional goal (Mellon, 1997). The emphasis of instructional design is not to determine how the information will be taught or the exact content but, rather, what the student will be able to do that demonstrates

competency in the goal (Dick & Carey, 1990). If designers of instruction analyze and understand the goals that they have for learners and how they will evaluate the learners' learning before developing instructional materials, then designers and instructors can save a great deal of time and money (Mellon, 1997).

### ***Identify and Sequence the Objectives***

Instructional objectives are specific, measurable, short-term, observable student behaviors that are the foundation upon which you can build lessons and assessments that helps to meet the overall course or lesson goals. An instructional objective is a statement that describes an intended outcome of instruction (Mager, 1984). Objectives help to activate a mental set that focuses student attention and directs selective perception of specific lesson content (Gagné, 1985). According to Ausubel (1968) stating an objective at the beginning of instruction will help the individual learners to structure their own learning. Reiser and Dick (1996) state, "At a fairly early stage, learners should be informed of what it is that they are going to be able to do when they finish the instructional process. By knowing what will be expected of them, learners may be better able to guide themselves through that process" (p. 48).

According to Hannafin and Peck (1988), the first step in design is to determine the sequence in which the objective will be met. They stress the importance of sequencing. Sequencing the objective helps create the outline of the instructional material. There are different ways of sequencing objectives such as topical, known to unknown, general to specific, chronological, and step by step. There has also been research conducted on sequencing objectives from a learning hierarchy in an attempt to generate a minimal memory load sequence (Nesbit & Hunka, 1987). After the sequence has been determined, instructional content (information) and activities for each objective identified are selected. The objectives, information, and descriptions of activities are then transferred to storyboards.

### ***Identify Instructional Material (Information)***

A significant part of the instructional process involves presenting students with the necessary information for learning (Reiser & Dick, 1996). All models of direct instruction include presenting information to students. Gagné (1985) stresses the importance of emphasizing the information presented to the learners. He mentions that distinctive features of what is to be learned should be emphasized or highlighted

when the information is presented (Gagné, 1985). In addition, content presented should be chunked and organized meaningfully (Kruse & Kevin, 1999).

Moreover, instructional material should be provided for all the objectives of the lesson. It is not advisable to provide a lot of extra instructional material outside of the learning objectives; instead, provide material that is aligned with the objectives for the lesson.

### ***Identify Examples to Support the Instructional Material***

Examples are verbal or graphical information that provides additional clarification of rules or information presented to learners. Kruse and Kevin (1999) include examples, nonexamples, graphical representation, and analogies as guidance strategies that can be used to further clarify new content that is presented. A considerable amount of research has been conducted recently on the effects of worked examples as an instructional aid (Atkinson, Catrambone, & Merrill, 2003; Atkinson, Renkl, & Merrill, 2003; Renkl, Stark, & Gruber, 1998).

### ***Design Practice Activities***

Practice is defined as the event of instruction provided to learners after they have been given information required to master an objective (Gagné, 1985). Practice involves eliciting performance from learners. It provides an opportunity for learners to confirm their correct understanding, and the repetition also increases the likelihood of retention (Kruse & Kevin, 1999). Practice is effective when aligned with the assessment in the form of a posttest and with the skills, knowledge, and attitudes reflected in the objectives (Reiser & Dick, 1996).

### ***Provide Feedback***

Feedback can be defined as “knowledge of one’s performance provided” (Delgado & Prieto, 2003, p. 73). Practice provides an opportunity for feedback that confirms the student’s answer as being correct or indicates that it is incorrect. Feedback strengthens the probability of correct responses and reduces the probability of subsequent incorrect responses (Philips, Hannafin, & Tripp, 1988). Kulhavy and Stock (1989) define feedback as information consisting of two components: verification and elaboration. Verification is the simple, dichotomous judgment that an initial response was right or wrong. Elaboration consists of all substantive information contained in a feedback message. Providing feedback in response to written

instruction increases the amount of correct information remembered from the target material (Kulhavy, Yekovich, & Dyer, 1979). Feedback facilitates criterion performance as it corrects the inaccurate information obtained during instruction, and it has little effect on correct responses where the learner has correct understanding of the text information (Kulhavy & Anderson, 1972).

### ***Review the Key Points in the Instructional Material***

The review process typically provides an outline of the key information that was presented to learners. It is intended to reinforce learning at the end of the instruction, often just before students are tested. Reiser and Dick (1996) cite the value of reviews to bring closure to instruction and to help reinforce the skills and knowledge students should have acquired.

Mattiske (2001) suggests that a review activity immediately after participants have learned something new reassures them that they are learning. Klein, Spector, Grabowski, and de la Teja (2004) suggest that learners should be given time to reflect and review after new information has been presented to them. Gagné, Wagner, Golas, and Keller (2005) indicate that spaced reviews should be given to learners to help them retrieve and use newly acquired information.

### ***Design Assessment Aligned with Objectives***

Assessments are used to determine whether, and to what extent, learners have acquired specific knowledge or skills based on the instructional goals and objectives of the lesson. The assessment should focus on outcomes of student learning, and it should be aligned with the objectives and be meaningful. Herman, Aschbacher, and Winters (1992) state that learners perform better when they recognize the goal, see models, and realize how they have been performing in comparison to the standard. Assessments should also be designed in such a way that they measure the learning of all the objectives in the instructional material.

### ***Identify Instructional Media/Technology***

Selecting the appropriate media and technology that can be used in the instructional material is extremely important. Care should be taken not to select media just because they are available. The majority of instructors use media that are *off the shelf*, that is, ready-made or easily accessible. However, the purpose of the media

selection process is to determine the best medium. Choosing the right medium should result in an efficient and effective learning process (Bevell, Martin, Ozogul, Su, & Zhang, 2003).

Media should be selected based on different criteria such as learning outcome, instructional strategy, learner characteristics, and instructional setting. Hence, aligning the media used based on the other instructional elements is important. The purpose in media/technology selection should not be to show the mastery of the technology, but to select media that best magnify learning.

### ***Identify Instructional Strategies***

Instructional strategy for course delivery is the approach used to present information in a manner that achieves learning and performance. Approaches include face to face delivery, blended or hybrid delivery, computer/web based lessons, tutorial, gaming, simulation, etc. Some of the aspects of the instructional strategies include the order of presentation, level of interaction, and testing strategies. Some of the commonly used instructional strategies are lectures, self-directed learning, case study, projects, demonstrations, discussion forums, cooperative or collaborative setting, and small group activities. A variety of learning technology tools/learning management systems are available in the market today, and that makes it easier for the instructional material to be delivered online or in a blended setting. Even most of the face-to-face classes use learning management systems as a supplement to deliver the course material (Martin & Dunsworth, 2006). With the presence of rich learning environments, it is important to consider which instructional strategies can best be utilized for different delivery options. Just as in the traditional classroom, instructional strategies are most effective when employed specifically to meet particular learning goals and objectives. Hence, the alignment between the instructional strategies and the other instructional elements is critical.

### ***Instructional Alignment***

The uniqueness of this paper is its emphasis on instructional alignment in the design phase. Instructional alignment is the process by which the different instructional elements are connected to each other and, in the end, makes the instructional material effective. For example, it is important to align the goals with the objectives in the lesson. The instructional objectives have to be aligned with the information, examples, practice/feedback, and review. The instructional media and strategies have to be aligned with all the different elements.

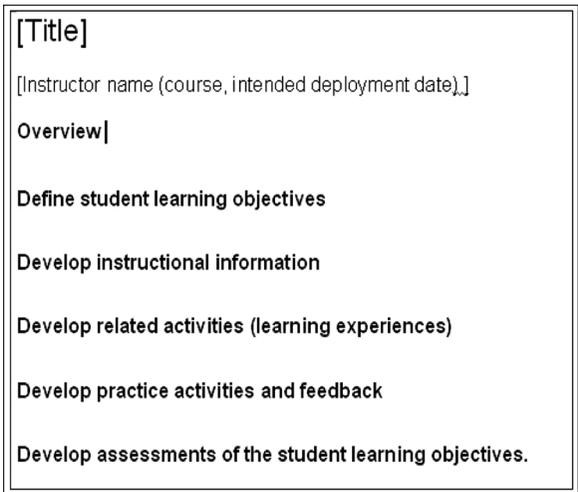
If these steps are aligned with each other, the quality of instruction designed is higher. Alignment within the instructional elements is commonly mistaken with curriculum alignment, which is aligning curriculum with standards. Instructional Alignment can also be defined as aligning curriculum with appropriate goals, objectives, content, teaching strategies, and assessment. This paper describes two types of design models that were used in the creation of instructional material on Digital Visual Literacy.

Described below are the two design models that the faculty used for the design document.

**DESIGN PROCESS 1 (TOP-DOWN MODEL)**

In the first process, the design document had the title, an overview of the course, learning objectives, instructional information, related activities, practice activities, and feedback and assessments. Each of these items was listed one below the other, and the connection between each of these items with the previous item was in a top-down manner. This can be called the top-down model. (see Figure 2)

The instructional elements in Figure 2 were linked in a top-down manner, and the linking between the items in the elements was unclear (e.g., The relationship between objective 1 and the assessment item connected to it was unclear). Instructors design the outline in a top-down manner. They write the objectives and then think about



**Figure 2. Top-down instructional design model.**

information, related activities, practice, and assessment. However they do not link each of the items with one another. So, there is no proper alignment between each of these elements.

### ***DESIGN PROCESS 2 (MATRIX MODEL)***

In the second process, the design document is in the form of a matrix. The instructional elements (objectives, information, practice/feedback, and assessment) are listed as columns and the objectives refilled as rows. Due to lack of space, the matrix can be transposed such that the instructional elements can be listed as rows and the objectives are listed as columns. (see Figure 3)

In the matrix model, the goal of the instructional program is first listed on the top. The matrix can be filled either by rows or by columns. Either way, the alignment between the elements is still maintained. Some instructors choose to enter the objectives first and then proceed to the second column, where they enter the information. But while doing so, they make sure that the alignment between the objectives and the information is maintained. This process is continued with the practice activities and the assessment items.

Other instructors choose to do one objective at a time. They list the objective, enter the aligned instructional material, then enter the practice activities and assessment for that particular objective. They continue in the same manner for the other objectives. For information, most of the instructors had an outline of slides or handouts or other material that they had designed. It was advised that the practice activities that they design be aligned with the assessment type. For

Instructional Design Matrix _ Module Name			
Goal:			
Objectives	Information/Examples	Practice with Feedback	Assessment

**Figure 3. Instructional design matrix.**

example, if an Excel project was the final assessment, then a guided practice Excel activity was used as the practice item. Instructors were advised to provide feedback on the practice activities before the students were assessed. This made it possible for the students to correct their understanding of the concept. Assessments were well aligned with the objectives and normally came with a clear rubric for grading.

Figure 4 is the instructional design matrix for the Copyright module that was created as part of the National Science Foundation DVL project. Information was provided as content on Powerpoint or Webquests that the instructor used to demonstrate. Practice was provided using practice challenges and other assignments. The final assessment was a multiple choice posttest. The practice activities and assignments were designed in such a way that they would help students answer the questions on the posttest. There was alignment between objectives, information, practice, and assessment. The matrix model tended to be more effective in the design of material with instructional alignment. In both cases, faculty were given a template to help them in creating an instructional module. The five main elements—objectives, information, practice with feedback, and assessment—were listed on both the template and the matrix.

Instructional Design Matrix _ Visual Practical Copyright Module			
Goal: The student will demonstrate knowledge of basic copyright guidelines and apply them to situations in the workplace.			
Objectives	Information/Examples	Practice with Feedback	Assessment
1. Explain how copyrights support the economic value of images	VPC Powerpoint Presentation	Assignment #1	Posttest #2
2. Describe basic copyright law and terminology	VPC Powerpoint Presentation	Assignment #1-10	Posttest #1-10
3. Identify the rights individuals have to images they have created	VPC Powerpoint Presentation	Assignment #2	Posttest #4
4. Identify public rights to images under the Fair Use doctrine	VPC Powerpoint Presentation	Assignment #3	Posttest #5
5. Describe the challenges digital technology has created for determining copyright status	VPC Powerpoint Presentation	Assignment #5 & 8	Posttest #2, 8-10
6. Given workplace scenarios, apply copyright guidelines to identify and resolve potential issues	VPC Powerpoint Presentation, All Web Quests	All Practice Challenges, Assignment #2-9	Posttest #4-10

**Figure 4. Instructional design matrix for the visual practical copyright module. This material is based upon work supported by the National Science Foundation Grant No. 0501965. Visual Practical Copyright Module created by John Gibson, Glendale Community College.**

**Revised Instructional Design Matrix**

Based on the feedback received after pilot testing some of the instructional modules developed, an additional three elements were added to the existing ones in the instructional design matrix. The elements that were added after the first iteration were review, instructional media, and instructional strategies (see Figures 5 & 6).

**EFFECTIVENESS OF INSTRUCTIONAL DESIGN ELEMENTS**

This matrix used by the faculty to design the Digital Visual Literacy module was evaluated by a group of instructors in the Maricopa Community College system in the United States. A 26-item survey was sent to these instructors to find out the effectiveness of the elements in the revised instructional design matrix. The survey questions are included in the results section.

**Participants**

Thirty-two instructors from the Maricopa community college system participated in this paper based survey.

Instructional Design Matrix			
	Objective 1	Objective 2	Objective 3
Goal			
Objectives			
Information			
Examples			
Practice			
Feedback			
Review			
Assessment			
Instructional media			
Instructional strategies			

Figure 5. Revised Instructional design matrix–blank.

## Instructional Design Matrix – Example - Know your Computer Module

Goal	Objectives	Information	Examples	Practice
<p><b>Objective 1</b></p> <p>Students will be able to explain what computers do and how they work.</p>	<p><b>Objectives</b></p> <p>Describe the concept of the input operation in a computer.</p>	<p><b>Information</b></p> <p>A computer accepts data that are provided by means of an input device. Peripherals used to transfer data from the outside world into a computer system are called input devices.</p> <p>Input devices let users enter commands or data into the computer. Most familiar is the keyboard. Information typed at the keyboard is manipulated by the computer program to perform a specific action or to enter text into a document. The mouse is another input device based on either a rolling mechanical ball or some optical device in its base, and usually two buttons on top.</p>	<p><b>Examples</b></p> <p>Keyboard is the most common input device of a computer. Pressing the keys on the keyboard sends messages to the computer. It consists of number keys which send numerical information, letter keys which send text information, and additional function keys for control purposes.</p>	<p><b>Practice item #3</b></p> <p>A peripheral used to transfer data from the outside world into a computer system is called input device</p> <p>Processing device</p> <p>Storage device</p> <p>Output device</p>
<p><b>Objective 2</b></p>				

Feedback	Review	Assessment	Instructional media	Instructional strategies
<p><b>Objective 1</b></p> <p>Input device is correct</p>	<p><b>Input Devices</b></p> <p>Keyboard Sends messages by pressing keys Mouse Sends data by clicking Joystick A rotary lever and used in computer games Digitizing tablet Pointing device which inputs drawings Touch sensitive screen Interacts by touching the screen Light screen Draws directly on the screen</p>	<p><b>Assessment item #6</b></p> <p>Which of the following is called "point and click" device? Magnetic reader Optical mark reader Mouse Digital camera</p>	<p><b>Instructional media</b></p> <p>Graphics, Simulation of the Computer</p>	<p><b>Instructional strategies</b></p> <p>Web-based lesson</p>
<p><b>Objective 2</b></p>				

**Figure 6. Revised Instructional design matrix–Completed. (Color figure available online)**

### *Survey*

The survey had 26 questions, and the faculty were asked to rate it on a Likert scale of (4 = strongly agree, 3 = agree, 2 = disagree, 1 = strongly disagree). The survey had two categories of questions: (a) How important it is to design each of these instructional elements?

(b) Do they currently design these instructional elements in their lessons?

### **RESULTS**

The survey results are tabulated in Table 1.

#### *Are Instructional Elements Important?*

The mean of the items rated on the basis of importance was  $M = 3.69$ . Importance of instructional goals was rated the highest at  $M = 3.91$  followed by importance of instructional objectives ( $M = 3.88$ ). The importance of designing instructional material for all the objectives was rated the lowest ( $M = 3.42$ ); the next lowest rated item was if this matrix helped the instructors in aligning instructional elements in the lesson ( $M = 3.48$ ). It is to be noted that though these items were the lowest on the survey, they were still rated between agree and strongly agree, showing that the instructors agreed on the importance of these instructional elements and on the matrix helping in the alignment of the instruction. The instructors had also rated the importance of aligning the instructional elements ( $M = 3.60$ ).

#### *Do I Design These Instructional Elements?*

The mean of items that were rated if instructors used it in designing their lessons were  $M = 3.37$ . The importance of instructional alignment was rated at  $M = 3.60$ . I design instructional goals was again rated the highest at  $M = 3.60$ , followed by I design instructional objectives at  $M = 3.50$ . Designing of instructional material was again rated the lowest at ( $M = 3.07$ ), with the next lowest being providing feedback and reviewing key points at  $M = 3.27$ . Instructor response average for aligning the instructional elements in the design of instruction was rated at  $M = 3.33$  and using the instructional design matrix for instructional alignment was rated at  $M = 3.28$ . Again, it is to be noted that all the items were above  $M = 3.00$ , which shows that all the items

Table 1. Survey results

	Importance of the items	I design them	Mean
<b>A. Instructional goals</b>			
1. Instructional goals are important in the design of instruction.	3.91		3.91
2. I start designing my lessons by identifying the instructional goals.		3.61	3.61
<b>B. Instructional objectives and sequencing</b>			
3. Instructional objectives are important in the design of instruction.	3.88		3.88
4. I design instructional objectives for my lessons.	3.45		3.45
5. Sequencing instructional objectives is important in the design of instruction.		3.50	3.50
6. I also sequence the instructional objectives after I have designed them.		3.39	3.39
<b>C. Instructional material (information)</b>			
7. It is important to design instructional material (information) for all the objectives.	3.42		3.42
8. I design information material needed for all the objectives.		3.07	3.07
<b>D. Examples to support instructional material</b>			
9. It is important to support the instructional material with aligned examples.	3.72		3.72
10. I design examples for the information provided in my lessons.		3.40	3.40
<b>E. Practice activities</b>			
11. It is important to support the instructional material with aligned practice activities.	3.81		3.81
12. I design practice activities for the information provided in my lessons.		3.48	3.48
<b>F. Providing feedback</b>			
13. It is important to support the instructional material with feedback for the practice activities.	3.66		3.66
14. I design feedback options for the practice activities in my lessons.		3.27	3.27
<b>G. Reviewing the key points in the instructional material</b>			
15. It is important to review the key points in the instructional material.	3.72		3.72
16. I design review for the key points in the lessons.		3.27	3.27
<b>H. Assessment aligned with objectives</b>			
17. It is important to design assessments aligned with the objectives in the instructional material.	3.78		3.78
18. I design assessments aligned with the objectives in the lessons.		3.30	3.30
<b>I. Selecting instructional media/technology</b>			
19. It is important to select the appropriate media/technology that can be used in the instructional material	3.78		3.78

(Continued)

Table 1. Continued

	Importance of the items	I design them	Mean
20. I select appropriate media/technology that can be used in the instructional material.		3.48	3.48
<b>J. Identify instructional strategies for course delivery</b>			
21. It is important to select instructional strategies that are most effective.	3.78		3.78
22. I select appropriate instructional strategies that make my lessons most effective.		3.45	3.45
<b>K. Instructional alignment</b>			
23. It is important to align each of these 10 instructional elements with each other.	3.60		3.60
24. I align the different instructional elements with each other in my lessons.		3.33	3.33
<b>L. Instructional design matrix for instructional alignment</b>			
25. The instructional design matrix helps in aligning the instructional elements in the lesson.	3.48		3.48
26. I would use the instructional design matrix to help me provide alignment in my lessons.		3.28	3.28
<b>Mean</b>	<b>3.69</b>	<b>3.37</b>	<b>3.53</b>

were rated as important, and that instructors mentioned using most of the instructional items in designing their lessons.

The overall mean on the survey of all the 26 items in both the importance category and the I design them category were  $M = 3.53$ .

### **IMPLICATIONS FOR PRACTICE**

The importance of these items was once again stressed by the faculty, even though some agreed that they had not used them in the design of the lessons to the extent that it was important. Also, it was interesting to note the consistent ratings of the items in both the level of importance and I design them. Instructional goals and instructional objectives were not only considered important, but instructors also agreed that they are the two items included in their lessons most of the time.

This research has implications for the design and development of all types of instructional material (print based, computer based). The important elements of the design process have been pointed out, and the importance of alignment between these instructional elements has to be kept in mind in the design of instructional material. Using the matrix model in the instruction design process saves much time

and makes the instructional material more effective compared to just using the top-down approach.

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