

A TECHNOLOGY INTEGRATION MODEL AND WEAK AREAS

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ABSTRACT: A re-evaluation of previous technology integration cases suggests that there are some weak areas in the process of integration. A new developed 3-D information technology integration model provides new directions of technology integration, which emphasizes on merging *Information* and *Technology* into the framework of *Instructional Design* theories and models. Some examples of integration in computer-based-instruction application designs, and integration case design are discussed.

Introduction

A re-evaluation of previous technology integration cases suggests that there are some weak areas in the process of integration. A new developed 3-D information technology integration model that emphasizes on merging *Information* and *Technology* into the framework of *Instructional Design* theories and models is used to analyze the process of technology integration, and guide the design of the integration. Some examples of integration in computer-based-instruction application designs, and integration case design are discussed.

Weak Areas in Technology Integration

Technology Integration Cases

In a previous study, we reviewed 102 cases relating to integrating information technology into K-12 classrooms and higher education, including 67 cases of using technology in K-12, 24 cases at undergraduate and graduate levels, and 11 cases in teacher training and faculty development (Johnson, and Liu, 2000).

In these cases, computer technologies were used to teach/learn reading, writing, mathematics (algebra and geometry), science, social studies, geography, and English literature, to design interdisciplinary curriculum (e.g., middle school science curricula that involves social studies and language arts); to develop critical thinking and problem solving skills (e.g., assessing information, analyzing ideas, and reorganize knowledge), to enhance mathematical thinking (e.g., concrete-abstract thinking processes), to teach children with special needs (e.g., children with hearing impairments, LD or ADD children), to motivate student learning (e.g., by establishing positive attitudes towards learning), and to create a culturally supportive environment in multicultural classrooms (e.g., for students with Asian, or Spanish cultural background).

Re-Evaluation of the Cases

We re-evaluated five major components that contribute to the success of the technology integration cases: (1) Using software: Software used in these cases could be sorted into two categories: tool software and information software. Tool software is for designing or creating teaching/learning applications or other products (such as graphic or photo products). The software itself is not for learning, but a tool to enhance learning. Information software, typically, is educational software that provides knowledge, information for learning. Most successful integration cases used software as an instruction tool rather than information source. (2) Using Web based instruction: The use of Web can be sorted into two categories—using Web to deliver instruction, and using Web as information resources. (3) Designing learning processes: The learning processes were designed in two ways: general learning, and task-based or problem-based learning. General learning is to use technology tools (educational software or Web) to learn general information on the learning topic. Task-oriented learning is to learn the knowledge by complete a task or solve a problem. (4) Instructional design: two instructional approaches were used to design the learning processes in the cases – Learner centered (constructivism) approach and teacher-centered approach. (5) Designing multimedia courseware—computer based instruction.

Weak Areas

From the re-evaluation of the cases, we find two weak areas which are consistent with the findings from a review of literature. First, in most cases, technology is added, not integrated, into learning or teaching; and emphasis is on exploring how to use certain technologies, without relating the use of technology to learning goals and objectives. A lack of instructional design results in the incomplete or unsuccessful technology-based learning. For example, when using certain educational software, experiences or discussions are focused on what the software can do and how to use it; not reaching the point yet to merge the use of technology into instructional design principles or models.

Second, very often, assessment results provide a broad range of information on the effectiveness of technology integration, which usually is too broad for educators, especially school teachers, to have a clear picture that frames the major components of technology integration. Most of the time, they tend to look at and learn from certain specific successful cases. While this is not technically incorrect, it does limit them from exploring the full potential and true nature of technology integration.

For the purpose of exploring the true nature and operational procedures of technology integration, we use a new developed three dimensional (3-D) integration model (Liu, and Bryant, 2002) to analyze the major components of technology integration and how they logically relate to one another.

A 3-D Information Technology Integration Model

The 3-D Model

The three dimensions in the model are: (1) information, (2) technology, and (3) instructional design. The 3-D integration model is a merge of uses of information and

technology into a system that follows the rules, theories or models of instructional design. In the 3-D model, the first dimension – information – stands for the learning or teaching contents and any assisted resources and materials; the second dimension – technology – implies any hardware/software tools that can be appropriately utilized to support or enhance learning and teaching; and the third dimension – instructional design– indicates a set of rules of instructional design that frames the first two running within the system, which is defined as “integration.” In this model, each of the three dimensions goes towards different direction, and individually each has different functions, emphases, and issues regarding to their contribution to learning. In fact, however, an effective learning will never occur on any single one dimension of the three, or certain combinations of two; instead, it is the outcome from the *integration* of the three: Information (I), Technology (T), and Instructional Design (D).

What Is Missing?

Analyzing the cases with this 3-D model, we discovers that in most unsuccessful integration experiences, (1) content information is not analyzed with instructional design principles, and no evidence to show any careful content decisions such as types of content (Eggen, Kauchak, and Harder, 1979), the order to present the content according to the levels of difficulty and generality (Ausubel, 1963), or the scope, focus and sequence of the content in a lesson unit (Gunter, Estes, and Schwab, 1999); (2) Technology is used separately from content and instructional design. No careful analysis of the purpose and procedures of using technology relating to learning goals, objectives, or instructional procedures and strategies.

The missing portion is – integration design, which must be based on instructional design theories, principles, or models. We will discuss two examples of utilizing this 3-D integration model.

Utilizing the 3-D Integration Model

Designing a Computer Based Instruction

Computer based instruction refers to programs developed with multimedia authoring tools for the purposes of instruction, learning new information, or reinforcing previous knowledge. The program can be a lesson segment, drills or exercises, test, or instructional games. Using computer based instruction program, learners learn from their interactions with the program. This is a learning centered environment.

In designing a computer based instruction program, the 3-D integration model can be used as a framework to make decisions about learning content, use of technology, and instructional strategies and procedures. Decisions about learning content include: learning objectives and goals, topic selection, relevant information, the difficult level of the content, the match of content to the learners thinking level or cognitive stages, organization of the content, logical sequence of the content, and so on.

The technology decisions are, for example, (1) to determine the information format (text, graphic, animations,...) that consistent with the learning goals, learners thinking level, the nature of the topic and content; (2) to determine the types of media

production that match the information format (text file, html file, jpg file, video avi file, or sound wav file? ...); (3) to determine the design details such as the techniques and effects to gain attention, stimulate thinking, motivate problem-solving, or reduce the level of anxiety; (4) to determine the structure and navigation of the program (linear structure or non-linear hyper-structure) according to the learning objectives, learner's characteristics, and type of the program. (5) to determine the

Before the computer based instruction program is used for student learning, it should be evaluated with a set of criteria within the framework of the 3-D model, tested and revised to match the learning objectives.

Computer Based Instruction Integration Case Design

To use the program to achieve certain learning goals, we need to design the integration. Again, instructional design is the core of the integration design. To conduct an integration case, we need to consider:

- The learning objectives,
- Learning topic and content,
- Learners' level
- Learners' computing skills
- Computer accessibility
- What the program can do,
- How the content of the program matches the learning content,
- When is the appropriate time to use this program, before, during, or after new content,
- Whether the program is used to individual practice or group activities,
- Whether of what kind of supporting materials need to be provided for the activities,
- Strategies to evaluate the learning
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According to the analysis results of all the related issues or factors, a lesson plan should be well designed that reflects the merge or integration of the three components in the 3-D model. This process is the design of technology integration.

Summary

In most cases we reviewed, the case conductor started an integration project/case without having a careful design; some even did not have any design. We have discussed a complete structure of design of technology integration, from analyzing the learning goal/objectives, available technologies, the functions of the technology, theoretical background that support the use of the technology to achieve the learning goals, procedures of implementation, evaluation of the outcomes, to the redesign of the integration. It is out hope that the 3-D technology integration model could be an initial model for educators and researchers to conduct further practice and research.

References

Ausubel, E. (1963). *The Psychology of Meaningful Verbal Learning*. New York: Grune and Stratton.

Eggen, P. D., Kauchak, D. P., & Harder, R. J. (1979). *Strategies for Teachers*. Englewood Cliffs, NJ: Prentice Hall, p 36-37.

Gunter, M. A., Estes, T. H., & Schwab, J. (1999). *Instruction: A models approach*, 3rd Edition. Boston, MA: Allyn and Bacon.

Johnson, D. L., & Liu, L. (2000). First steps toward a statistically generated information technology integration model. *Computers in the Schools*, 16(2), p. 3- 12.

Liu, L., & Bryant, N. (2002). An information technology integration system and its life cycle: What is missing? *Computers in the Schools*, 20(1/2), (in process).