An Instructional Design Methodology

that encourages Students involvement in Course Design and Implementation.

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Abstract

The basic concept of instructional design, or ID, is not entirely new to the education system. Many forms of curriculum are designed based on a model framework to achieve successful outcomes. The argument, however, is based on the type and implementation of a model to meet the needs of a curriculum and to achieve the best outcomes. Within this paper an attempt will be made to examine how a specific ID model is implemented to achieve specific outcomes within a geographical setting. To illustrate the ID model, three key topics will be analyzed. First, an explanation of the methodology used. Second, how various learning theories are applied. Finally, a sample project to reinforce the applied methodology. The paper will then conclude with a viewpoint about instructional design.
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Methodology

Our Instruction Design method was born from a synthesis of many sources; ADDIE, Anchor and Agile methods of software engineering were the three primary sources for our methodology. We elected to call our methodology the EPBSDE. This acronym denotes what we see as the six major steps in building curriculum and knowledge. We see the endeavours of building curriculum and knowledge is synchronistic in that the best way to build knowledge is to teach it. Or in this case prepare to teach it by building curriculum. We prove our model by building an example course, which in turn challenges the students to complete an anchored assignment using our model.

EPBSDE

The EPBSDE acronym is for Envision, Plan, Build, Stabilize, Deploy and Evaluate. Our model borrows the EPBSD from the Microsoft Solutions Framework and the final E comes from ADDIE. We consider our methodology a hybrid of the latest from Instructional Design (ID) methodology and the latest from Software Development Life Cycle (SDLC) methodologies. This hybrid methodology is forward thinking for we Envision as we analyze. It is holistic for our Planning includes interdisciplinary opportunities and emerging technologies. It is dynamic for as we Build we leverage the audience (customer) focused nature of Agile software development methods. It is resilient and interoperable for we utilize quality assurance practices, open standards and criterion proofing as we Stabilize. It is complete for we ritualize Deployment by having a formal hand-off to the systems operations group. It is continually improving for we Evaluate its strengths and learn from its weakness. We believe that by including the discipline of software engineering to technology based curriculum development we build upon the strengths of the current set of ID methodologies. By adding the rigor and
dynamics of software engineering we strengthen the deployment process and reduce technical risk.

Over the last decade a number of trends have emerged in relation to ID. These trends include the influence of Information Technology (IT) upon ID, as evidenced by the Cognitive Flexibility work begun by Spiro (1995) and with the utilization of Rapid Prototyping and other technologies in courseware development. It would seem the utilization of IT continues to influence ID methodologies and this will continue as greater understanding of learning develops and as enabling technologies are synthesized into “knowledge building”. From the current “crop” of emerging technologies come the Agile software development methodologies. These methodologies build upon the effectiveness of Rapid Prototyping where the customer (or user) comes first. From Agile come user stories, tighter iterations, frequent delivery, test driven development and refactoring. All of these techniques would free the curriculum development team to focus on content and learning modules instead of the software engineering issues present within current ID.

**Anchor**

As a group we chose to add an anchor approach in developing our methodology. We felt it was important to give the students real world problems (an anchor) to solve and to encourage interdisciplinary opportunities to deepen their knowledge in many of the disciplines they are learning. As Wilson (1993) stressed in his work that it is important to create scenarios where people are faced with real world learning than the linear problem solving found in traditional learning methods. “…However, the limitations of linear ID become apparent when working in ill-defined content domains, or when working with highly diverse populations…”
Learning Theories

When developing an Instructional Design (ID) model for the practical use of meeting the curriculum objectives in a course, teachers must decide on the proper implementation of various learning theories that best fit each segment of the ID model. Three theories, in particular, that would be necessary to meet the needs in this example are direct instruction (DI), constructivism, and cognitive thinking. To allow for coherency and consistency within the ID model, each of these theories can be blended throughout. The challenge for teachers, however, is create a model that is open for more constructivism and cognitive thinking rather than an abundance of DI. Learning is much more meaningful if the child is allowed to experiment on his own rather than listening to the teacher lecture. The teacher should present students with materials and situations and occasions that allow them to discover new learning (Piaget in Ginn, 1995).

Direct Instruction

For the purpose of this model, much of the directed instruction will be completed in the beginning stages explaining key concepts and other necessary components to achieve proper comprehension of the objectives. As cited by Huit (1995), direct instruction is direct statements of objectives, where sets of activities are clearly related to the objectives, careful monitoring of progress and feedback about achievements and tactics for achieving more effectively are linked with sets of guidelines for facilitating learning. Much of the DI for this model will take place in the planning stages. Once an anchored subject is selected, the teacher can begin to examine interdisciplinary opportunities and requirements and identify existing and required skills and resources. In these stages, teachers would use DI to explain some of the foundation needed to meet the instructional outcomes. Using geography as the anchored subject component, DI would
have to be used to explain such foundational concepts as latitude, longitude, various types of weather patterns, using image and spreadsheet software, and formatting skills.

**Constructivism**

Much of this model would require constructivism to be implemented. Constructivism is viewed as a constructed entity made by each and every learner through a learning process. Knowledge can thus not be transmitted from one person to the other, it will have to be (re)constructed by each person (Dept. of Information Science, 1999). In the planning and building stages, the teacher would be able to use constructivism when identifying interdisciplinary opportunities, and identifying the existing skills that the students comprehend. Establishing what students already know creates an opportunity in the building stage to develop constructive skills, collaborate efforts and develop opportunities to construct knowledge toward their assigned task. Essentially, this model enables students to construct and advance their learning about the assigned task.

**Cognitivism**

This type of learning theory will usually occur in the planning, building, and stabilizing stages. When developing the assigned task, students will use mental constructions to plan, build, and deploy their assigned task. Students will actively process information that will allow them to examine concepts more critically and question their own procedures. In the planning stage, students will be able to tap into their existing skills in various subject areas, such as information technology, geography, and mathematics. Also, students will be able to critically think about the procedure and assessment of the assigned task prior to launching their final product. The teacher would be responsible to allow students the time necessary to critically analyze their design model. By allowing this step to occur, it gives students time to pilot their
project and for refactor prior to the deployment of their final production. At the deployment stage, cognitivism should be fully developed to allow both teacher and the students time to reflect on the effectiveness of the ID model.

**Sample Project**

This section will apply the EPBSDE model to a project, which would be sponsored by the Geography department of a typical Canadian high school. The project will provide opportunities for students to see the real-life use and interconnectedness of their studies.

**Envision**

The first step is to ‘Analyze Needs within Curriculum’. This project has determined that there is a need for Geography students to be familiar with the following concepts:

- Latitude and longitude
- Impact of physical geography on human activities
- Impact of weather conditions on human activities
- Realities of human movement between regions

The instructional outcomes are:

- Be able to identify locations from latitude and longitude.
- Understand why certain harbours are more suitable than others
- Identify basic weather patterns from satellite photos and understand reports
- Understand rules and regulations between countries (e.g. customs)

These outcomes must be clearly defined in order to ensure that the design does not pursue tangential outcomes.

**Plan**

The anchor subject, and basis for the activities, is to, “**Plan a 4 week summer holiday trip on your private yacht.**”
Once this has been decided, then step two, “Look for interdisciplinary opportunities and requirements” can be properly applied. The cognitive aspects and tools (IT and other) required are detailed in guiding points contained within a chart (please see Appendix A) for the students to follow. The anchor could then be revisited if needed, to accommodate any opportunities.

To outline interdisciplinary opportunities, the chart notes individual skills and concepts required by students at the beginning of the project. What do the students already know, and what do they need to be taught? It is argued that a solid instructional model approaches the teaching and learning from three levels, behavioral, cognitive, and constructivist, and perhaps should be approached in this order. The chart demonstrates this approach with the constructivist aspect of item 6 (view item 6 in Appendix A) as the main, but last part of the project. This is reflected in the assessment value of this item in relation to the others.

**Build**

The three first steps of this stage of project development are necessarily performed concurrently. Each learning module contains elements which require skills from different subjects. Although some IT skills, such as formulas in spreadsheets, may have already been covered in other subjects, these skills may require ‘fine-tuning’ or refreshing to suit the project. Thus, the need to consult with the subject specialists in each area is apparent. The designers must focus on the purpose and use of IT tools, for as Jonassen (1998) indicates, they “… should be used as knowledge construction tools that students learn with, not from.” For the higher order tasks, or those which fall into the constructivist approach, designers must consider that planning the trip is a complex task. There are clearly certain tasks which must be done first, but there are also tasks which may be done in different orders. Spiro (1995) cautions against
explanations or procedures, “… which represent the instructional domain and its associated performance demands in an unrealistically simplified and well-structured manner.”

While assessment should not drive the development of the project, it must be considered. For skills which require direct instruction, Mergel (1998) comments that with, “…behavioral objectives a learning task must be broken down through analysis into specific measurable tasks.” Again, consultation with subject specialists is required to ensure that the requisite skills are reasonable expectations for the level of the students.

**Stabilize**

This step of the planning is to stabilize the project in terms of timing and resources. For the sample project, the following questions must be addressed:

- Are there enough school computers and support staff available for students?
- Are the computers going to be available at appropriate times?
- Are other teachers able to teach the requisite skills?

Clearly these issues must be first addressed when planning the project, but once the activities have been more clearly defined, such issues must be readdressed to ensure access to the requisite resources. In the actual implementation of the project, there is also a stabilizing factor that may be referred to as ‘Criterion Proofing’. Once students have made determinations about where their destination at the outset of the project, the teacher must quickly determine if their proposal will enable them to meet the assessment criteria for the project. This last element is key for any project using this model because it is the constructivist element, and where the ‘real’ or deep learning will take place. It is here that they will analyze, synthesize, and evaluate their new-found information in terms of Bloom’s taxonomy (See Mergel, 1998).
Deploy

In this sample project, deployment would begin by dealing with the direct instruction of skills that will be required. The planning stage would have dealt with the issue of which step is first. For example, direct instruction in image editing must precede the overlay of weather maps on the proposed route.

Evaluate

The project will be reviewed to see what worked and to what degree teachers felt that the various aspects worked. If students had trouble overlaying photos on their maps, then the appropriate teacher should determine if this was due to lack of training, or to lack of good maps, or an inability to access the proper web sites. It is not enough to identify a problem, but the actual cause of the problem must be determined in order to improve the project for next time.

Conclusion

A good instructional design model provides a structure and process within which a lesson or project can be comprehensively constructed. A good model allows a problem to be explored in a manner that accounts for the skills and tools required to produce outcomes, but is not driven by these tools. A good model then guides the development of activities and assessment, but is not driven by the assessment. A good model also has the capacity to evaluate itself and strive for improvement, both before and after implementation.

However, a strong model is one that is driven by the needs of the students within their curriculum. From this need, all tools, skills, outcomes and activities can be derived.
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### APPENDIX A – Interdisciplinary Opportunities Chart

<table>
<thead>
<tr>
<th>Item #</th>
<th>Requirements</th>
<th>Interdisciplinary Opportunity</th>
<th>Instructional Approach</th>
<th>Assessment % weighting</th>
</tr>
</thead>
</table>
| 1      | You must plot your course on a map using latitude and longitude  
• Understand Latitude and Longitude  
• Use grid maps  
You must enter at least three different ports | Geography: Latitude and Longitude  
Information Skills: Research on ports | Direct Instruction / Cognitive Skills | 20% |
| 2      | You must overlay satellite weather photos on your map | IT: Image software  
Information Skills: Research on weather | Cognitive Skills | 5% |
| 3      | You must consider your budget and prepare a spreadsheet detailing costs.  
• Your spreadsheet must include formulas (Average, Autosum)  
• Your spreadsheet must show cell formatting (number, text, currency, alignment) | Math: Budgets Formulas  
IT: Spreadsheets (Excel) | Cognitive Skills | 20% |
| 5      | You must prepare a ship’s manifest. | Information Skills: Research  
English: Formal Report formats Planning | Cognitive / Direct Instruction | 5% |
| 6      | You must prepare a report:  
• Detailing all of the above  
• Providing justifications of your choice of ports  
• Discuss the impact of weather on your routes and contingency plans in case of inclement weather.  
• Justify choice of materials and food.  
• Account for crew and duty roster. | Geography:  
English: Writing styles  
IT: Formatting skills  
Inclusion of various media  
Excel / Word for scheduling chart | Constructivist / Cognitive | 50% |
APPENDIX B – Methodology Flow Chart

The EPBSDE Model

ENVISION

- Begin by analysing the domain. Building / having a complete understanding of the curriculum and its objectives is key to continued curriculum development. Once opportunities for working within existing curriculum have been identified, the instructional context needs to be set and learning outcomes developed. The context identifies the learners and their entry knowledge to the subject.

- Identify instructional outcomes
- Analyze needs within curriculum

PLAN

- Divine an anchor subject. This anchor would also include the review and / or creation of interdisciplinary opportunities and curriculum requirements. Learning modules can then be identified. These should fit within the time constraints of the course and draw upon the most appropriate learning theory (i.e. Direct, Constructive or Cognitive). Each module should be grounded in an instructional strategy.

- Identify anchor subject
- Identify interdisciplinary opportunities and requirements
- Identify existing and required skills and resources

BUILD

- Building the course material will be an iterative process including content and assessment tools. Once the lesson content is nearing completion and close to launch, the lessons will be piloted to get feedback from practical use.

- Create learning modules
- Create assessment tools
  - Develop skills activities
  - Develop cognitive activities
  - Develop opportunities to construct knowledge

STABILIZE

- The purpose of the stabilisation step is for quality assurance (QA), curriculum outcomes reconciliation and overall project assessment. When QA discovers errors (bugs) they are sent back to the “create / modify” step for fixing. The content will need to be integrated with the Learning and Content Management Systems (LMS & CMS) to ensure it will work within the existing learning systems. All developed curriculum will also become an input into the envision phase.

- LAUNCH
- Quality Assurance & Release Management

DEPLOY

- The phase of deployment is the activity of releasing the new learning system for use. In general, deployment signals project completion to free the development team up to begin another curriculum development project.

- Release / Operational Handoff

EVALUATE

- Once the release has been in production for a period of time, a thorough evaluation (ranging from usage, to completion measures, and overall satisfaction of all the project stakeholders) needs to be performed. The evaluation becomes input to the next envisioning phase, and to reiterations of the project.

- Project Evaluation

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