Applying the ID Process to the Guided Design Teaching Strategy

A Case Study

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Abstract. This article describes the application of the ID process to an instructional technique called Guided Design. Guided Design is an approach to teaching that is intended to teach decision making skills within the context of a given content area. This case study traces the development of a Production-Operations Management course from the client's initial contact with the developer to the final evaluation of the course. To implement the Guided Design technique in the course it was necessary to complete a comprehensive task analysis of the content, develop mastery level self-instruction units, group activities to serve as synthesizing exercises for the content, as well as grading and course management procedures. Student final performance on major course goals was assessed and indicated mastery. The article concludes with the personal observations of the developer and the client about the project and discusses some of the implications of this experience for developers.

This article is divided into two major parts: a description of a development project and some personal reflections on the development process itself. The piece focuses on the real world application of the ID process to a teaching strategy called Guided Design. Boxed ID models are missing but not the underlying logic and success of the process.

Part I: The Development Process

Greg and I first met in the Fall of 1978 when he asked me to observe one of his lecture classes. He had been teaching classes of 30 or so students at another university but now found himself in a large lecture hall with over 250 students. While discussing my observations he mentioned that what he really wanted to do was use a technique that he had experienced success with when teaching at another university. The technique, developed by Wales and Stager (1977) at West Virginia University, is called Guided Design. Greg wasn't sure, however, that the technique could be adapted to a large lecture situation. As we began to examine its assumptions and the constraints in a large lecture situation we felt that, through a careful application of the ID process, we could overcome most of the problems of implementing the Guided Design process.

Guided Design

Guided Design emphasizes teaching students to learn decision-making skills through applying their knowledge about content material to the solution of a complex problem. Unlike case studies, students are not given all the background material and data at one time and asked to deal with the problem *en masse*. Instead, they are led through the problem step-by-step. For example, students might be told just to define the problem and then set their objectives before even considerng possible solutions. In general, Guided Design projects proceed in the following sequence of steps:

1. Define the problem.
2. State the objective(s) of your work.
3. List any constraints which limit possible solutions, assumptions which you must make to solve this problem, and the facts which you know.
4. Develop a list of possible solutions and evaluate these possibilities using appropriate criteria.
5. After selecting one solution, synthesize this solution.
6. Present the results in the form of a report.
7. Evaluate the results. (Wales and Stager, 1977, p. 17)

Usually, each of the above steps corresponds to an instruction which is given to the students, who work in groups of three or four. After a group has performed the instruction, they receive written feedback describing how an experienced decision-maker might have performed the instruction. This feedback is intended only as a *guideline* and *not* as a correct answer. The feedback also provides the next instruction. In this way, students are led through an entire decision-making exercise.

Unlike a standard lecture class, time in a Guided Design class is used for work on projects. Students must learn the content material on their own outside of class and then apply this knowledge to the assigned problem in class.

Thus, two significant instructional problems must be solved to implement a Guided Design course: (a) the content must be taught at a mastery level outside of class; and (b) having learned the content, the problem-solving process must be taught. The content is typically taught by self-instruction materials. The problem-solving process is taught using group projects which are strategically designed to afford maximum utilization of the content in solving the problem presented by the group project.

Design of the Course

At Southern Illinois University at Carbondale, Administrative Sciences 318, Production-Operations Management is a three credit course serving approximately 500 students per year. Students learn basic concepts and procedures used to plan, schedule, and control the production of goods or services. It is, by nature, a very quantitative course requiring more individual interaction and explanation than can normally be accomplished in a lecture format. To implement the Guided Design system in this course, we needed to focus on four major aspects of the instructional system: self-instruction units, group projects, grading, and the course management system. However, before focusing on any of these components it was necessary to specify course goals and prerequisite tasks to these goals.

Specification of Goals and Prerequisite Skills

The American Production and Inventory Control Society has, as a professional group, specified the basic skills that a professional in Operations Management would have. Using this documentation as a starting point, we established the goals of the course to meet these standards. Following this, we performed a task analysis of these competencies with the intention of generating the map or instructional blueprint for organizing both the content and problem-solving components of the course.

The overall course goal is to have students formulate a production plan for a production-operations management problem. The analysis of this goal shows that the learner must be able to integrate three broad planning processes into a single whole. These procedures include forecasting, aggregate planning, inventory control, and capacity planning strategies. Each of these techniques can be further broken down into its component parts. Figure 1 represents the task analysis for the course. The task analysis also points directly to the proper placement of problem-solving exercises in the classroom. These problem-solving exercises are best placed at the intersection of component parts for a given task, e.g., in a forecasting problem one would place the guided design exercise at the intersection established by joining the content of moving averages, exponential smoothing, and regression analysis. At this intersection the students have learned the content necessary for approaching the problem-solving exercise in the limited context of forecasting decisions.

Note that the task analysis is built in two directions. It proceeds from the most basic unit at the bottom of the task analysis to the most complex, comprehensive unit at the top. We have also placed the most basic components of the production plan on the left side and have proceeded to the more complex issues on the right. Using this procedure we find that forecasting techniques are crucial to understanding both aggregate planning and inventory control problems. Similarly the guided design exercises can come at the confluence of aggregate planning component parts and inventory control parts. Thus conditions are established wherein the student gains both content and problem-solving experience in each segment of the overall course structure. It also becomes logical to insert the final course problem-solving exercise at the confluence of the larger components. In Figure 1, A, B, C, and D represent the placement of guided design exercises within the content structure of the course and specifies the location of the final exercise. The analysis stage of the project was completed at the end of the Spring, 1979, semester.

Self Instruction

For the guided design strategy to be effective, students must learn the content outside of class using self-instruction materials. It is essential that these materials be developed following a systematic procedure which will guarantee that students possess the prerequisite skills prior to attempting to solve the problem. While several approaches are possible in designing self-instruction materials, Faust (1977) has proposed a model that is particularly useful in selecting appropriate instructional strategies based on specified objectives. Figure 2 illustrates Faust's model for teaching rules. In developing an instructional segment the expected learner outcome is stated, the rule defined, examples are presented to illustrate the expected behavior and opportunities for practice with feedback are presented. The "Help" steps provide explanations and instances which indicate to the learner when and how the rule is to be used.

At the end of the instructional segment students complete a posttest. If a student does well on the posttest it is assumed that the material has been learned. Typically there is no formal check for determining student performance on the posttest. However, students who do poorly on the posttest are expected to review the area of difficulty within the self-instruction segment. If they continue to have difficulty assistance can be requested from the instructor.

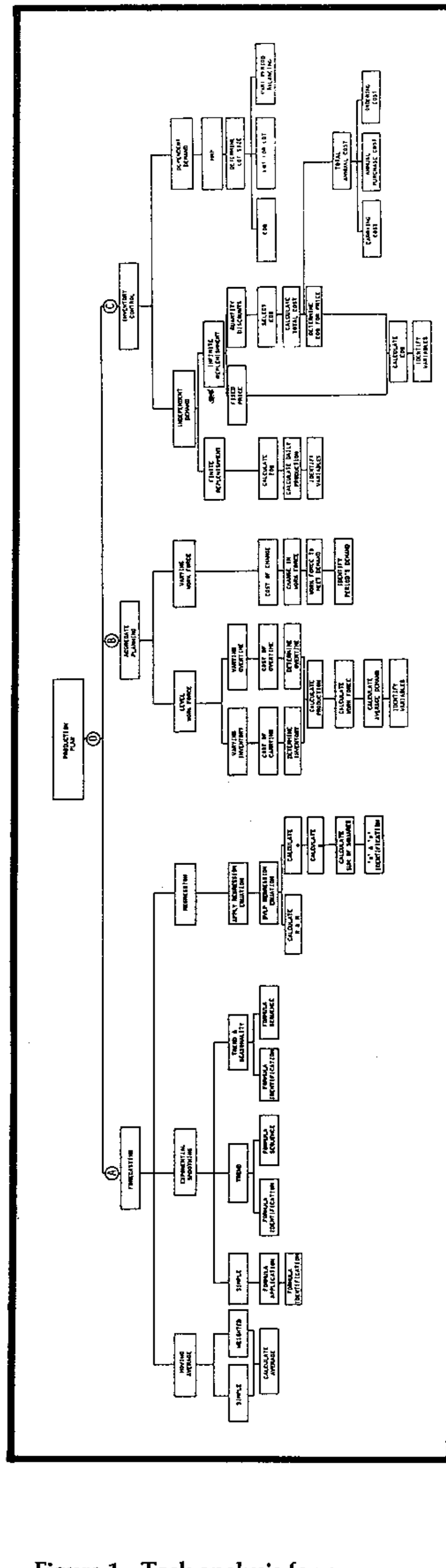

Figure 1. Task analysis for a Production-Operations Management course.

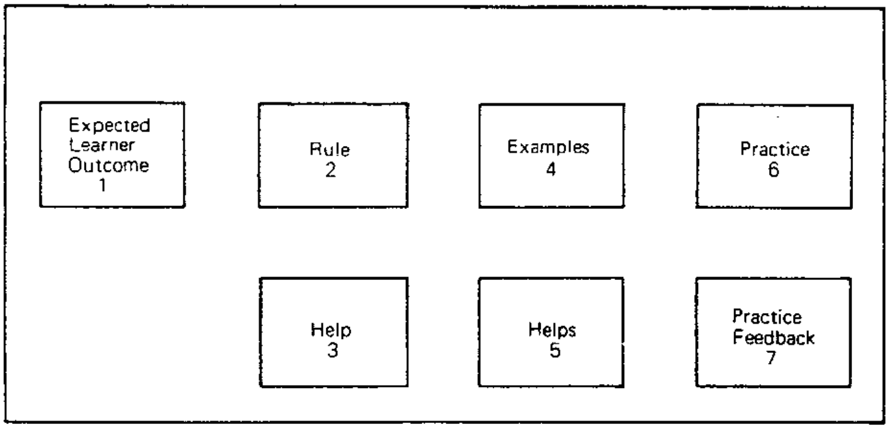

Figure 2. Model for teaching rule use.

Each of the units was developed to match the skills outlined in the task analysis. Greg wrote each of the units generally following Faust's procedures. Over 300 pages of text were written during the summer of 1979.

Group Projects

To teach problem solving skills, the Guided Design strategy relied on the use of group projects. Projects in a Guided Design course are intended to promote student learning of the problem-solving process through solving open-ended problems. Because of the size of the class, it was necessary to reduce the feedback from seven to four steps. (This reduction was necessary due to the logistical problems in dealing with a large class. If seven steps were used, the instructor would spend most of the time simply handing out feedback sheets rather than interacting with the groups, e.g., in a class with 12 groups the difference between seven steps and four is 84 feedback steps versus 48.) Thus, the groups of three to five members were guided through these four consolidated instruction-feedback steps: problem definition; constraints, assumptions, facts; possible solutions; analysis and synthesis.

Problem definition. Students were started in the right direction immediately by defining the problem. Once the problem was clearly defined, the students' knowledge of the material usually enabled them to determine what was expected. Students were directed to define the problem by considering the symptoms, causes, and objectives. Explaining the differences between causes and symptoms in the instruction statement will usually assist the students' success at this step.

Constraints, assumptions, facts. At this step students are given an explanation of the differences between constraints, assumptions, and facts. They then must determine the factors that will influence their possible solutions.

Possible solutions. This step allows one last check on the direction each group will take in solving the problem. It is also a time for creative thinking or brainstorming to determine as many solutions as possible. At this point the relationship between the project and the content should be clear to the students.

Analysis and synthesis. This step is usually the longest and should be closely coordinated with the content material. Students are required to break the selected solution down into meaningful elements and then seek information to develop each element. Then they must combine each element to create a detailed solution.

Developing and Implementing the Projects

There were a total of five different projects for the groups. The first project, developed by Wales, was an introduction to the Guided Design process. In this project, the group is asked to deal with a situation in which they are stranded on a desert island and must develop a survival plan. The focus here is on the steps in the Guided Design process. The remaining four projects were operations management problems with real world referents. With the exception of the first project, which required only one day to complete, the other projects each required approximately three weeks to complete. These projects were written during the Summer session in conjunction with the self-instruction materials.

Grading. As we were concerned with both content skills as well as problem-solving skills, two grading systems were established. One was based on content, the other on group projects.

Content. To assess competence on the various content objectives three tests and a final examination were administered drawing primarily from objectives in the self instruction materials.

Group Projects. Each unit of the course culminated in a group project that required the group to exercise the problem-solving skills taught in the course. The grades from these projects were weighed with the test grades to determine final course grades. An interesting problem that arose in dealing with the group projects was the varied level of participation of each group member in the project. In an attempt to manage the system somewhat more effectively than exhorting each to participate, three approaches were tried. Eventually we settled on a peer rating system that would motivate those less inclined to participate more fully.

The first approach was to check off the name of each student when feedback was provided. The time when an instructor or assistant has direct contact with each group is when written feedback is provided. At this time, each student's performance was evaluated by checking off the names of those people who worked on the instruction. Unfortunately, this system proved time consuming and unreliable, e.g., students tended to "cover" for each other.

The second approach was to evaluate oral reports. Rather than using individual written reports, each group's work on a project was evaluated through an oral presentation of 3-5 minutes. Each group was

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given an overhead transparency on which it was to specify the details of its solution. The transparency required completion of specified items so that groups could be compared. We had hoped the oral presentation would provide sufficient peer pressure to motivate the group members as well as show the diversity of solutions possible in solving each problem. The presentations did spark discussion but consumed large amounts of time without changing non-participant behaviors.

When these failed to work as well as we wanted, we turned to the third strategy—peer evaluation.

For the peer evaluation, anonymous rating of each group member is made by all other members. Adjustments to a final grade on a project are made on the basis of those ratings. Members who are rated as contributing nothing can receive a zero grade for the project.

Course Management

Our first problem in executing the course was finding a place for individual groups to work on their projects. After talking with the university scheduling division, we arranged to have one large room in addition to the large lecture hall. The class was divided into three groups, and each group met on a different day of the week in the large room. In this way, one instructor was able to handle 180 students, dealing with only 60 at a time. During the time they were not scheduled into the large room, each group was free to meet outside of class. The large lecture hall was used only to administer tests or periodically bring the class together to discuss problems, e.g., an extra lecture on forecasting strategies.

To insure that students wouldn't fall far behind, a detailed schedule was distributed which specified exactly what they should be working on each day of the week. Thus students knew when they had to begin a self-instruction unit, when it had to be completed, and what progress they should be making on a given project.

Finally, we established a computerized grading system to handle the peer ratings on each project. Since each student was rating each of the members of the group, the mass of data justified the time to create the system. Printouts indicating each student's individual test and project grades, as well as their average, were continuously posted outside the instructor's office. At any time, a student knew how he or she was doing.

Evaluation

After development, the course was first introduced into the Fall of 1979. Considerable time was spent during the term in fine tuning the materials and procedures. During the Spring of 1980 a series of studies was begun that focused on the cognitive gains made by the students. Using test items designed to assess 11 specific goals, we compared performance of the Guided Design class to another section in which material was presented through lectures. (Students self selected sections of the class. As we were concerned about possible sample bias due to self selection, we distributed a short questionnaire asking the students to list their reason for choosing a particular section. Over 95% indicated convenience of schedule as the primary reason, rather than familiarity with the instructor, instructional technique, or other reasons.) On these eleven items, the 180 Guided Design students averaged 94.9% compared to an average of 80.8% for 86 students in the control group. In the Spring of 1981 on a similar test 141 Guided Design students averaged 93.4% compared to 71.8% for 142 students in the control group.

Other more qualitative data is now being collected focusing primarily on the dynamics of the group process. It is interesting to note that many of the students have complained that the course is "too easy." It seems that they feel learning ought to be more difficult in a college course. Given the performance of the students on test items referenced to professional competencies, one finds this complaint more damning of current educational practice than an indictment of the course design. It appears the ID process did work for the course.

Part II: Reflections on the Process

This project was particularly satisfying to both the instructual developer and the instructor. Along the way we dealt with a variety of issues, some personal, some professional, that may be worth sharing.

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From the Developer

(A) *Reaction to the problem.* When Greg first mentioned that he really wanted to use Guided Design, I thought "Oh no, he has a solution in search of a problem." As a general rule clients often confuse the symptoms and the problems and seek solutions to their symptoms rather than their problems. As it turned out, the Guided Design process was a reasonable strategy to use in this situation. What made the project different from other Guided Design projects was its use of the ID process. None of the Guided Design projects currently reported have combined the elements of task analysis, praxiological theory, and large group lecture settings.

(B) *Abject horror.* When I explained the ID process to Greg, it made great sense to him. I immediately knew I was dealing with a "non-normal" client. His willingness to accept the ID process also brought about a sense of abject horror on my part. With one exception I have never worked with a client who would buy the whole ID process. Most have to be cajoled into accepting bits and pieces. When Greg just asked for guidance on what to do throughout the project, my one constant fear was, "What if we do everything we are supposed to do and it all fails?" I haven't shared this with him until today.

(C) *Presence, or lack thereof, of an ID model.* There was no single ID model used in this project. What we relied on was a general sense of the systems approach to creating and managing the instructional system. To the extent we did use a model, it consisted of determining our goals in light of the entry level of the students (a professional judgment made by Greg without any formal analysis of entry skills), the task analysis, development of materials, implementation, and ongoing evaluation of the system. Given the informal nature of our relationship there didn't appear to be a need to follow a specific set of steps—indeed to have outlined them so concretely probably would have caused us to lose some of the flexibility and fun of the project.

(D) *Task analysis.* This phase of the ID process was absolutely critical to the success of such an undertaking, and was accomplished in record time. Greg's analytical bent (his B.S. is in Mechanical Engineering) and the structure of the discipline combined to make the task analysis process a dream come true. The analysis was essentially accomplished in one afternoon with a six-pack.

(E) *Development of the materials.* I chose Faust's model as the template for the units as it is both theoretically acceptable and relatively easy to understand and execute. All of the materials were print packages which were duplicated for the cost of $7.00. In this cost was included a $2.00 fee that was added to a departmental account to help fund research activities associated with the course. This strategy thus helped generate funds to be used for the course, while providing students with a set of materials that cost less than most texts in the field.

From the Client

(A) *Motivation for the project.* I had previously used the Guided Design approach, but only in conjunction with a standard text, in teaching classes of about 30. It seemed to work pretty well. However, when I tried to use it in a limited way with my large classes, the results were disastrous. I was overwhelmed by the sheer volume of students. The text I was using did not relate well to my projects which confused the students. Also, I had insufficient time to work closely with each group. I ad pretty well decided to give up Guided Design and just lecture when I asked Bill to observe my class. I thought he could help me make up some good transparenices (a job which, I've since learned, Bill hates).

Bill is probably right that I was a non-normal client. However, it is important to understand that after experiencing the excitement of working on an individual basis with small groups, I was ready to try anything in order to avoid a mass lecture. (Obviously, I do not get my kicks from playing Johnny Carson to a group of bored students).

(B). f2Task Analysis. Basically, the task analysis is what made everything work. I had previously thought about the structure of my course and how it all fit, or didn't fit, together, but had never formally analyzed it. Using a text, I followed the author's organization, only occasionally rearranging chapters. This often led to a vague feeling of dissatisfaction, but no real idea about how to reorganize the material.

The task analysis really forced me to look at what I wanted the students to learn, and how it all fit together. Today, because of the way we analyzed it, the course material forms one unified whole. Students progress in a logical sequence from one topic to the next. The material flows smoothly and builds upon itself. Students can quickly see that one unit is important because the next unit builds on it. At the conclusion of the course, students complete a project which ties all the material together, reinforcing the importance of understanding the linkages between separate components.

"Thus students knew when they had to begin a self-instruction unit, when it had to be completed, and what progress they should be making on a given project."

(C) *Value of the ID process.* The entire ID process was extremely useful for me. I was able to develop a course the way *I wanted it,* rather than following someone else's text. It forced me to state explicitly what my objectives were and examine ways of getting there. I had to specifically identify how one concept or idea related to others in the course. While this did take some time, it was well invested. Besides, sitting around in the afternoon with a six-pack doing task analyses can be great fun.

Today, colleagues are very impressed with the organization and structure of my course. They are surprised when I show them the *depth* of material my students learn, and become incredulous when they see how well students perform on tests. For me, the ID process has produced very positive results. Even though Bill might have had doubts, I always felt that what we were doing would work out. If it didn't, we could always go back to making up transparencies!

Some Implications for the Developer

If there is an organizing primciple to the success of the project, it must be flexibility in application. Many of our clients feel there is a best way for them to teach. While, in this case, Guided Design was presented as a preferred teaching strategy, other clients in other disciplines often have equally strong preferences for a particular strategy, e.g., the inquiry approach. While most of us would prefer to begin a project without the constraints of a given strategy, it is possible to apply the principles of ID to the strategy and create an effective instructional system. This tactic not only enhances the strategy, but saves a great deal of wear and tear on the developer-client relationship.

Flexibility in accepting the client's assumptions about the teaching process needs to be carried over to other aspects of the ID process. Specific models and PERT charts are useful only if they fit into the client's style. In this case, they didn't fit and no attempt was made to find a fit. What was there, however, was a general systems approach that underlies most ID models. However, there was no room for flexibility in this project when it came to the task analysis. The whole project turned on the successful completion of this process. In this case, the client grasped and enjoyed the process (!). Had he balked, we would have tried other strategies to gather the task information, but flexibility here would focus on alternative ways of gathering this information, not going on without it.

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