SESSION 1566

The Balanced Scorecard in a Capstone Design Course

John I. Hochstein, Jeffrey G. Marchetta, William S. Janna

Department of Mechanical Engineering
The University of Memphis
Memphis, Tennessee

Abstract

In response to a perceived need to improve the project management skills of program graduates, the authors introduced the general principles and structure of the Balanced Scorecard (BSC) system to seniors in a capstone design course. This paper briefly presents the principles of the Balanced Scorecard, describes how they were introduced to the students, presents details of how the BSC was employed by one of the design teams, and documents students' evaluation of this application of the BSC. It concludes with the authors' assessment of this experiment and plans for future offerings of this capstone design course.

Introduction

For the last two decades of the 20th century, ABET exerted a relentless pressure on engineering education programs to make "design" a significant and measurable component of curricula leading to degrees granted by programs accredited by that body[1]. The paradigm shift embodied in ABET's promulgation of Engineering Criteria 2000[2] (EC2000) has provided more leeway in how programs deliver the design component of the curriculum, but the new criteria continue to identify "design" as a vital component of the curriculum. In fact, Criterion 3.c requires that "… programs must demonstrate that their graduates have an ability to design a system, component, or process to meet desired needs" and Criterion 4 requires a "… curriculum culminating in a major design experience …". Such a capstone experience is a major component of the Design of Thermal Fluid Systems course (MECH 4314), required of every student, in the Mechanical Engineering program at The University of Memphis. Continuous improvement processes conducted by the faculty of that program have identified a need to improve the ability of its graduates to effectively plan and execute an engineering project of significant scope to be conducted by a multi-disciplinary team. In an attempt to achieve this result, the 2003 Fall semester offering of MECH 4314 included a topic not previously included in that course: a very brief introduction to the ideas of the Balanced Scorecard[4]. The Balanced Scorecard (BSC) is not the only system currently enjoying success in the marketplace, (e.g., six-sigma, management by objectives, object-oriented management). However, the BSC system has achieved a surprisingly large penetration into the private sector during its less than 10 years of existence and it is currently being used as a management tool by the Mechanical Engineering Department. The senior design teams were asked to employ the ideas and structure of the BSC to help them plan and execute their projects. At the end of the semester, these students were asked to evaluate their experience with the BSC and to make recommendations for program improvement.

The next section of this paper briefly presents the principles of the Balanced Scorecard. The third section describes how these principles were introduced to the students in a capstone design course. The fourth section presents details of how the BSC was employed by one of the design teams. The final section documents students' evaluation of their experience with the BSC, the authors' (instructors') assessment of this experiment, and presents plans for incorporation of the BSC in future offerings of this capstone design course.

The Balanced Scorecard

Publication of *The Balanced Scorecard*[4] can reasonably be viewed as the foundation of a movement that continues to grow in magnitude throughout private[5] and public sector[6] organizations around the world: "Today over half of Fortune 1,000 companies in North America are using the Balanced Scorecard. … many public sector organizations, including the US Army, the Australia Department of Defense, and many others such as the Texas Education Agency, have recognized its value and are using the scorecard."[6] The collection of ideas, processes, principles, and the structure generally referred to as the Balanced Scorecard have at their root the recognition that "success" in today's marketplace requires assessment and improvement of multiple performance perspectives. Although the financial bottom line has meaning for any organization, it is at most only one performance perspective that should be measured to evaluate and promote an organization's success.

The title page of Reference 4 identifies the BSC as providing a system for "translating strategy into action." The authors of the present paper believe that the strength of the BSC lies in the structure of the system. That structure demands that an organization define the multiple performance perspectives required to achieve its own definition of success. Once the perspectives are defined, the BSC structure builds and drives a continuous improvement environment in which well-defined actions are pursued in an effort to improve performance in those perspectives. An entire industry of for-profit and not-for-profit consultants, associations, and software vendors has evolved over just the past few years to help any organization understand and adapt the BSC to their unique situation[7,8,9]. The breadth of ideas in the BSC is far greater than can be covered in this paper, or than could be presented as one component of a capstone design course. Therefore, as was done in the design course, a highly simplified and focused subset of BSC ideas, and only a part of its structure, are described below.

A basic premise of the BSC is that corporate success in the "new economy", (i.e. organizations spawned by the information revolution such as software vendors), requires excellent performance in multiple perspectives of performance. This is in contrast to more than a century of experience during which corporations thrived in the "old economy", (i.e. classic manufacturing concerns of the industrial revolution such as steel mills), by an almost solitary focus on the financial bottom line. In the early 1990's, a study of several companies from the banking, oil, insurance, and retail industries showed that the following four BSC perspectives aligned "individual, organizational, and cross-departmental initiatives" and identified "entirely new processes for meeting customer and shareholder objectives"[4]: financial performance; customer knowledge; internal business processes; learning and growth. Inherent in the BSC is the idea of a cycle in which an organization: defines what it wishes to accomplish; defines actions to be taken to realize these accomplishments; defines metrics by which success is to be measured; evaluates the level of success achieved by the actions; and then restarts the cycle. Although it may be convenient for an organization to synchronize as many cycles as possible, it is not necessary for all cycles within a BSC to operate with the same period.

The starting point in building a BSC is to write a Mission Statement in which the organization defines core beliefs, identifies target markets, and identifies core products. The following sentences provide a brief description of words that take on a very specific meaning in the context of the BSC. A *perspective* is a category of performance required to accomplish the stated mission. The organization must define as many as required to accomplish its mission. Although the four perspectives identified in Reference 4 were appropriate for the organizations participating in that study, they are not necessarily appropriate for a particular organization or application. An *objective* is a statement of what is to be accomplished. To be meaningful, it must be time-bounded, measurable, and reasonable. A *measure* is a way to quantify performance with respect to an *objective*. An *initiative* is a specific action, or set of actions, to be taken to accomplish an *objective*. An *outcome* is the result of completing an *initiative*. Assembling the preceding definitions in the order they were presented produces a cycle: define objectives, define measures, define initiatives, perform initiatives, and assess outcomes. In a well behaved system, the outcomes of the cycle should help to form the objectives of the next cycle.

As an organization becomes more complex, so must the BSC. For example, a simple organization such as a design team in a capstone design course might need only a few perspectives. All of the objectives might be defined by the collective of the entire design team and an initiative might be directly assigned to a team member. However, in all but the smallest organizations, there is of necessity some hierarchical organizational structure. A large corporation composed of multiple companies in multiple product lines at many sites will have an organizational structure to which the BSC structure must conform (or, perhaps, the organizational structure might need to change to conform to the BSC). One task in building an organization's BSC is to define the entities within the organization that are charged with defining their own components of the BSC. For example, top level executives would be charged with defining a BSC associated with "the big picture." Their performance objectives would be global in nature and the corresponding initiatives would probably require the actions of a large number of employees. It is unlikely that the executives would themselves execute an initiative. In the corporate context, perhaps one of the initiatives requires action by one and only one of the companies. It is likely that the executives charged with managing the company will also be tasked with defining a BSC for the company. To achieve a fundamental objective of the BSC, "translating strategy into action", the company's executives would adopt the corporate level initiatives as their own objectives. In turn the company executives would probably define company-level initiatives that would become the performance objectives for the next level of the corporation's BSC. Although the authors of the present paper have not seen such an analogy in their review of the BSC literature, this cascade has the flavor of fractals and chaos theory where similar and fundamentally simple structures are repeatedly found at every smaller (or larger) scales. Locking together the BSC from the largest to the smallest scales in the organization is the feature of the BSC that this paper's authors believe makes it a powerful system.

Adapting the BSC to a Capstone Design Project

In the authors' program, MECH 4314 Design of Thermal Fluid Systems is one of two required courses that include a capstone design experience. The students are asked to form teams of at least 3 and no more than 5 members to bid on a selection of projects (e.g. the projects in Reference 10). Each team has a Project Director who functions as a lead engineer would function in an industrial setting: she/he does not assign grades, but does make leadership decisions to guide the work of the team. Each team member keeps a written journal to document their efforts and the director meets once each week with the course instructor to review the team's journals and the team's progress in the project. Repeated failure of a team member to perform results in that person being "fired", and the team continues the design process without him/her. The project is the largest component of the course grade and teams must make oral presentations as well as submit a written report to document their design, and the process by which it was developed. A unique aspect of this capstone experience is the introduction of freshmen as "co-op" design team members[3]. One positive consequence of this unique feature is that all of the seniors, not just the Project Director, gain experience in planning and directing to work of other team members. In end-of-the-semester surveys, seniors have cited this as one of the most valuable outcomes of course (whether or not the specific interactions were good or bad). In past semesters, teams were asked to build a more or less traditional milestone chart to schedule the tasks to be accomplished. The primary vehicle to keep teams on schedule was the task planning sheet.

The BSC idea of multiple perspectives is clearly in line with Criterion 4 of EC2000 which requires: "… a major design experience … incorporating engineering standards and realistic constraints that include most of the following considerations: economic; environmental; sustainability; manufacturability, ethical, health and safety, social, and political."[1] The BSC, at approximately the depth of the presentation in the previous section of this paper, was introduced to the students enrolled in the 2003 fall semester offering of MECH 4314. There was no linkage to the course textbook and the students were not asked to read Reference 4 or any other BSC related materials. As a specific example of the general BSC principles and structure, the reorganization of the Mechanical Engineering Department's internal processes to better align the program with the requirements of EC2000 was presented[11] to the class. Students were then led through an exercise in which the BSC was applied to a hypothetical design project: Design of a Cat Washer. Collectively, the class defined the perspectives, objectives, initiatives, and measures appropriate for a design team working on such a project. The exercise resulted in a multi-tiered BSC that reached from the overall team mission down to the freshmen co-op students. Not surprisingly, one of the more vocal students voiced strong reservations about the value of using the BSC for such a relatively simple organization as a MECH 4314 design team. A vigorous discussion ensued that involved many students. The instructors repeatedly made the point that this was intended to be a learning exercise. Just as most "real world" engineering tasks are more complicated than homework problems, the application of the BSC in MECH 4314 would be less extensive than in a "real" engineering organization.

Example BSC Experience: Design of an Amusement Park Waterslide

A five-member team (M. Alfalah, J. Braal, D. Branham, S. Broadway, L. Gardner) was the successful bidder to design an amusement park water slide[10]. Figure 1 is a graphical depiction of the BSC this team developed for their project (with special thanks to Ms. Gardner for leading the BSC effort, for producing the graphics, and for providing the documentation). The team formed a company they called Thermal Technologies, hence the "TT" in the Fig. 1.

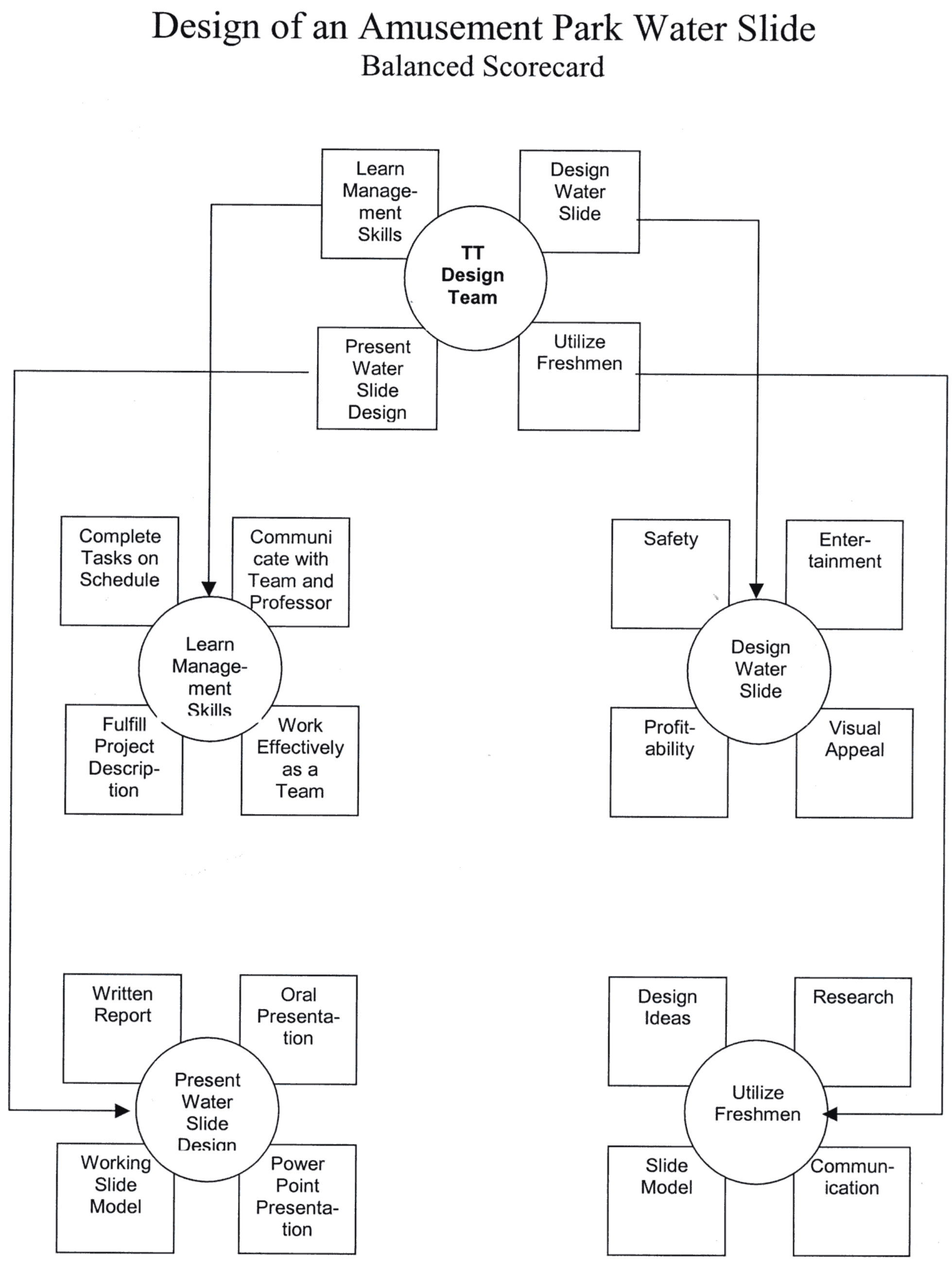

Figure 1 Graphical Depiction of BSC Adaptation to Water Slide Design Project.

The details of the BSC implementation for even this relatively straightforward application are more substantial than can be completely presented in a single figure, or on a single page. Figures 2-5 in the Appendix to this paper show the BSC details developed by the design team to "flesh-out" the perspectives identified in Fig. 1. Review of Figs. 1-5 shows that the students have begun to grasp many of the BSC ideas. There is recognition that "success" for the team will be measured from multiple perspectives: project management, design of the water slide, documentation and presentation of the design, and effective utilization of all human resources including the freshmen. Within each perspective, multiple objectives were defined, corresponding measures of success were defined, initiatives to accomplish the objectives were specified, and outcomes were measured. Instead of a cascade structure leading to the co-op students, this team chose to identify effective inclusion of the freshmen in the project as one of the top-level perspectives. The key components of a BSC are present in a reasonable level of detail. For example, some of the objectives are time-bounded, measurable, and reasonable but others are not. Some difficulties stem from the wording of the perspectives and others are just a question of how the objective was worded (e.g., change "make the slide as inexpensive as possible" to "create a design with a price structure that permits complete return on capital investment within the first 3 years of operation"). As a first attempt at adapting the BSC to a project, the evidence of Figs. 1-5 show a credible effort and a meaningful learning experience.

Assessment of the Experience and Conclusions

Just as there are multiple perspectives in the BSC, there are at least two perspectives of any coursework assignment; that of the student and that of the instructor. The water slide design team provided the following assessment of their experience with the BSC (which have been reproduced, verbatim).

Pros (Ways it helped our team):

- It was beneficial to have something to look at to see if we were accomplishing our goals.
- Filling out the BSC forced me to brainstorm ways to improve the project.

Cons:

- After filling out the perspectives, measures, and initiatives, we didn't look at the BSC again until time to fill out the outcomes. We didn't accomplish some goals, but we didn't notice until it was too late.
- It took a long time to fill out – time that could have been spent working on the project itself.
- I didn't feel like it meant anything. I just filled it in with things that I knew we would do anyway.
- I think the balanced score card was intended to be used to measure the work that the freshmen did, and I don't see how it would do that.

Other:

- It might help if the balanced score card was somehow incorporated into the task planning sheet. We used the task planning sheet to keep us on task and to measure our success. I think that is what we were supposed to use the BCS for, but we didn't. Trying to use both would be counterproductive because we would spend more time evaluating our progress than actually making progress.

- The Fluid Thermal Systems class is so time-demanding that the BSC was just something else to add to our long list of things to do. I don't think we understood the purpose or how it could help us.
- I think the BSC applies more to larger, more long term goals, such as the ME department example or a company's mission. Our objective for the design project was so straight-forward that it was hard to break it down into components and it wasn't necessary to lay it out in such detail.

These student assessments of their encounter with the BSC are revealing and similar to the instructors' perceptions of the experience. The design teams did not integrate the BSC into their day-to-day operations to the extent that had been hoped. It was viewed more as an "add-on", as another "thing to do", than it was as a system that could improve team effectiveness. The instructors believe this is due to a lack of regular insistence, on their part, for project progress reports reflecting the BSC objectives and initiatives. Both the students and instructors fell into old habits and relied almost exclusively on milestone charts and task planning sheets to track project progress.

The instructors view some of the student assessments with skepticism: "I just filled it in with things that I knew we would do anyway." Comparing all of the initiatives and objectives in the example project to past experience, it is clear to the instructors that the BSC induced the students to explicitly recognize important components of the capstone design experience that most, if not all, would have missed without their development of a BSC for their project team. Perhaps the fact that these insights were now judged by the students to be obvious is itself a credit to the BSC system.

The instructors believe that their first attempt at introducing the BSC to seniors in a capstone design course was a partial success. Many of the students have grasped the general concepts of the BSC at an introductory level. It is believed that this experience did "improve the ability … to effectively plan and execute an engineering project of significant scope to be conducted by a multi-disciplinary team," an objective itself defined in the undergraduate program's BSC. The current plan is to continue this experiment with the next offering of MECH 4314. An introduction to the BSC will be provided as soon as the design teams form. The most significant change will be a tighter coupling between the weekly progress reports and the team's BSC. It will be made clear to the students that the final design report will contain an appendix addressing how the BSC impacted their design experience and how introduction of the BSC could be improved for the next offering of the course. Questions exploring these issues will also be included in the end-of-semester course survey so that the continuous improvement process associated with the capstone design course can continue to march forward.

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Biographical Information

JOHN I. HOCHSTEIN — joined the faculty of The University of Memphis in 1991 and currently holds the position of Chair of the Department of Mechanical Engineering. In addition to engineering education, his research interests include simulation of micro gravity processes and computational modeling of fluid flows with free surfaces. He is a co-author of a textbook, *Fundamentals of Fluid Mechanics*, with P. Gerhart and R. Gross and is an Associate Fellow of AIAA. Dr. Hochstein received a B.E. degree from the Stevens Institute of Technology, an M.S.M.E. degree from The Pennsylvania State University, and a Ph.D. from The University of Akron.

WILLIAM S. JANNA — joined the faculty of The University of Memphis in 1987 as Chair of the Department of Mechanical Engineering. He was formerly Associate Dean for Graduate Studies and Research in the Herff College of Engineering. His research interests include boundary layer methods of solution for various engineering problems, and modeling the melting of ice objects of various shapes. He is the author of three textbooks, a member of ASEE and of ASME. He teaches continuing education courses in the area of piping systems and in heat exchanger design and selection, for ASME. Dr. Janna received a B.S. degree, an M.S.M.E. and a Ph.D. from the University of Toledo.

JEFFREY G. MARCHETTA — Jeffrey G. Marchetta joined the faculty of The University of Memphis in 2002. As a member of the AIAA, he received the Abe Zarem Award for Distinguished Achievement in 2000. His research interests include the modeling of flows with free surfaces, verification and validation of computational simulations, and magnetic fluid management in reduced gravity. Dr. Marchetta received a B.S.M.E. degree (1997), an M.S.M.E. (1999), and a Ph.D. from The University of Memphis (2002).

Appendix

Figures 2-5 are presented on the following pages to document the objectives, measures, initiatives, and outcomes developed by the TT design team for the BSC perspectives presented in Fig. 1.

Learning Management Skills Perspective

Complete Tasks on Schedule	**Fulfill Project Description**
Objectives: • To complete tasks on schedule according to the task planning sheet • To complete the entire project prior to the day it is due Measures: • Receive “satisfactory” grades from Dr. Janna at each weekly meeting because required tasks are completed. • Complete design, model, written report, and presentation prior to the due date. Initiatives: • Review task planning sheet weekly. • Update task planning sheet as needed to stay on schedule. • Commit to finishing individually assigned tasks. • Project Director will hold team accountable to finish projects by the due date. Outcomes: • The project was completed the day before it was due, except for the model • After one member was “fired” from our group, all tasks were completed on schedule according to the task planning sheet	Objectives: • To fully address each component of the project description Measures: • Address each of the 9 design components listed on the project description. Initiatives: • Determine: Slide dimensions and path, support structure and material, method for riders to come off the slide at the bottom, pump size, type, and location, piping material and routing, water additives required, slide layout, total cost of slide. Outcomes: • All components of the design were addressed in the final report.
Communicate with Team and Professor	**Work Effectively as a Team**
Objectives: • To communicate effectively so that the entire team knows the status of the project. • To communicate with the professor so the team understands due dates, requirements, and expectations. Measures: • Understanding of what is expected from the professor. • Full knowledge of the project status by all team members. Initiatives: • Hold regular weekly team meetings. • Form an email list to quickly share information. • Attend class regularly to be accessible to other team members. • Project Director will meet weekly with the professor. Outcomes: • Team was aware of what the professor expected and of what needed to be completed • Weekly meetings with professor and team provided effective means of communicating so everyone was aware of the status of the project.	Objectives: • To work together to complete the project with each team member sharing the responsibilities. • To interact with each other in a professional manner when working on the project. Measures: • Earn a grade that all team members deserve. • Finish the project with no ill feelings between team members. Initiatives: • Use the task planning sheet to divide assignments evenly among team members. • Share new information with the entire team so that everyone is on equal terms. • Project director will address any member that is not fulfilling his/her responsibilities. Outcomes: • One team member was “fired” for not completing his share of the project. The task planning sheet provided evidence that he knew his task and did not complete it. • The remaining team members worked well together and fulfilled their responsibilities to the team.

Figure 2 Learning Management Skills Perspective

Design Water Slide Perspective

Safety	**Entertainment**
Objectives: • To design the water slide so that riders and onlookers will be safe. • To specify criteria to be allowed to ride the slide to ensure safety Measures: • The water slide meets safely codes and standards. • The slide will not endanger a rider or spectator during normal operation. Initiatives: • Determine maximum and minimum height, weight, etc. to be allowed to ride. • Determine the maximum speed of the rider for safety and the flow rate to produce this speed. • Design run-out to slow rider to a stop comfortably and safely. • Design appropriate support structure. Outcomes: • The slide was designed to be safe for everyone involved (structure, design, etc.) • Criteria were set – rider must weigh less than 300 lb and be taller than 42 inches.	Objectives: • To design a slide that will be fun and thrilling to ride. Measures: • The slide should be fun to ride. • The speed should be fast enough to be thrilling. Initiatives: • Select an incline that will let the rider travel fast enough to be thrilling. • Design “racing” slides for the added pleasure of racing a friend down the slide. Outcomes: • The rider will travel 12 mph and will go down a 45 degree slope that should be fun and thrilling. • The ride is longer than most slides with fast drop-offs to add to the fun.
Profitability	**Visual Appeal**
Objectives: • To make the slide as inexpensive as possible to build and maintain. • To charge riders enough to cover operating expenses and earn profit. Measures: • The portion of ticket cost to support the slide should not be excessive or higher than average. • The operating cost should not exceed the profit expected from the slide. Initiatives: • Research all materials to find the material that is the least expensive to purchase and maintain. • Design the slide to require as little maintenance as possible. • Research ticket costs for similar water slides already in place. Outcomes: • The slide can be paid for in 3 years by increasing the admission price to the park by $5, with the park still earning profit each year. • After 3 years, the operating & maintenance (O&M) costs will be the only cost to the park and all other income will be profit	Objectives: • To design a slide that looks fun and thrilling. • To provide visual entertainment for visitors waiting in line for the slide. Measures: • The constructed slide is visually appealing. Initiatives: • Choose a theme for the slide decorations. • Use bright colors to make the slide inviting. • Place signs, advertisements, etc. on the steps leading up to the slide for riders to look at while in line. Outcomes: • This wasn’t addressed much by the design team. The company building the slide will be able to choose the colors and any signs around the slide. The model was constructed using blue and grey as the main colors since these colors support the University of Memphis.

Figure 3 Design Water Slide Perspective

Proceedings of the 2004 American Society for Engineering Education Annual Conference & Exposition

Present Water Slide Perspective

Written Report	**Oral Presentation**
Objectives: • To complete the report on time. • To thoroughly explain the design in the report. Measures: • Complete report on time. • Earn an A on the written part of the project. Initiatives: • Compile all information into one location. • Develop a well-structured layout. • Assign one or two team members to compile information into report. Outcomes: • Report was completed at midnight the day before it was due. • We received a B+/A- on the report. • The report thoroughly explained the design, including prints, specifications, and calculations.	Objectives: • To present the design information clearly and thoroughly. • To appear knowledgeable about all aspects of the design. Measures: • Be able to answer all questions that are asked. • Present the information so that the class understands the design. Initiatives:. • Review all aspects of the design as a team. • Practice public speaking skills to sound confident and prepared. • Assign individuals to talk about each point. • Practice the presentation at least once as a group. Outcomes: • The design information was presented clearly using a PowerPoint Presentation and the speaker did a good job of conveying the information to the audience. • The design team was able to answer all questions asked during the presentation.
Working Slide Model	**PowerPoint Presentation**
Objectives: • To build a model that pumps water through the slide. • To build a model that accurately demonstrates our slide design. Measures: • The model works. • The model is to scale and shows what the slide will look like. Initiatives: • Obtain funding from the ME department. • Choose a scale that allows parts to be purchased from modeling catalogues. • Choose realistic-looking materials. • Construct a pumping system that will pump water through the slide. Outcomes: • The model was not completed on time, but should be finished before the end of the semester. • The team decided to build a symbolic model to scale instead of a working model. • The model is to scale and will provide a good indication of what the slide will look like. • The model does not pump any water and "work"	Objectives: • To use PowerPoint to provide a visual for the oral presentation. Measures: • The audience is able to follow along and better understand the presentation. Initiatives: • Assign one or two team members to construct PowerPoint presentation. • Include key components of the design process. • Include 3-dimensional CAD drawings of the slide. • Plan a strategy for navigating the slides during the presentation. Outcomes: • The PowerPoint presentation showed the audience what the slide would look like and helped the presenter stay focused and present the information in a way that was easy for the audience to follow.

Figure 4 Present Water Slide Perspective

Utilize 1307 Co-op Students

Design Ideas	Research
Objectives: • To use input from co-op students in the basic slide design. • To inspire co-op students to take ownership in the project because they helped design it. Measures: • Co-op students provide design ideas. • Co-op students are interested in helping Initiatives: • Ask for input from the co-op students on the layout of the slide. • Inform co-op students of all decisions and ask for ideas for improvement. • Assign aesthetic improvements to co-ops. Outcomes: • 1307 students came up with a few ideas, but the team did not really use them. The ideas that we asked them to work on were mostly busy work because the team had already made the more important decisions.	Objectives: • To give research tasks to co-ops to save time and give them ownership in the project. Measures: • Assign research to co-ops. • Co-ops complete research assignments. Initiatives: • Divide the co-ops into groups and assign each group something to research. • Collect information from the co-ops at the meeting the following week. • Use the co-ops' research toward the completion of the project. Outcomes: • Each group had 1 or 2 members who assisted with research and the others did not do any research that they were asked to do. • 1307 students researched to determine what the slide should be made of, prices of parts for the model, ticket booth prices, etc.
Slide Model	**Communication**
Objectives: • To assign large portions of the slide model to co-op students. • To work with the co-op students so they understand what to do. • To make the model a fun climax to the project. Measures: • Co-op students show up to help with the model. • Co-op students enjoy working on the model Initiatives: • Set a meeting time outside the normally scheduled team meetings to build the model. • Provide the co-op students with a descriptive task list of what they should accomplish. • Have at least one senior present each time the co-op students are working on the model. Outcomes: • The materials necessary to begin the slide model did not come in until after the freshmen gave their presentations on the project. After that they were not required to meet with us, so they did not help with the model. One freshman did offer to help, even though his portion of the project for the class was over. • It was easier for a design team member to work on the model alone than to get help from 1307 students.	Objectives: • To open lines of communication between the 1307 co-op students and the senior design team members to use each other for help, ideas, etc. Measures: • Both parties are able to communicate with each other when necessary. • All individuals involved play a part in the design process and are aware of what is going on. Initiatives: • Establish an email list. • Distribute contact information to all team members. • Meet weekly with all senior and co-op students. Outcomes: • Meetings with 1307 students opened the lines of communication and allowed the design team to get ideas from the 1307 students. • Toward the end of the semester we did not have work for the 1307 students to do, so the meetings were unproductive and wasted time that the team could be using to work on the project and the 1307 students could be using to complete other homework.

Figure 5 Utilize 1307 Co-op Students