# Education and Simulation of Best Value in an International Academic Setting: A Case Study

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An innovative education and simulation of the Best Value (BV) business model was carried out in a Project Management (PM) course at an International Engineering University in Italy. The BV model has been applied in a variety of organizations and projects to minimize risk and increase performance; however, its use in education at the University level is less explored. The BV educational sessions held in the PM course revealed that BV is instructive because it educates students regarding PM concepts via an industry-applied model, and is transformational as it promotes a change in perspectives of the students and the instructors. The simulation was a course group project that utilized the BV concepts and tools, which revealed that BV is flexible because students realized their increased knowledge via the project, the project was easier to administer as compared to previous years, and it was multicultural as it was easily used in a course with individuals from numerous cultural backgrounds. The performance information of the course revealed that, compared to previous years, the project was clearer, evaluations saved time and limited subjectivity, and the students' performance increased overall. The BV business model contributed to positive transformative learning experiences.

Keywords: best value, business model, international, simulation, education.

## Introduction

Best Value (BV) concepts have been gaining worldwide attention as a business model and methodology to minimize risk on projects via supplier selection, pre-planning and measurements of project deviations. The BV system was originally developed at the PBSRG at ASU in 1994. The system has been tested on more than 975 procurements in $4.6 billion in procured services and construction, with a 98% client satisfaction rate, and variety of project savings and benefits with utilization of the BV System such as reduced changes (PBSRG 2012). Historically, BV concepts have been utilized for the execution of construction, service and commodity contracts, with effects such as improved efficiency and quality (Sullivan 2011). As a business model, BV has been well tested in various organizations and sectors as well as three large universities (Mselle 2009); however, it has not been tested in an international academic setting.

### *Background of Research*

With the goals of exploring the application of models for performance and transparency internationally, a lead research assistant with the Performance Based Studies Research Group (PBSRG) at Arizona State University (ASU) achieved a Fulbright Grant to investigate this

opportunity. The Fulbright Scholar (FS) sought to educate, create simulations, and hopefully test these concepts via the BV business model. The FS was given nine months to carry out the research at the Politecnico di Torino in Turn, Italy, from September 2011 until June 2012. The FS outlined three goals for the research period:

1. Education and simulation of the BV business model in academics
2. Hosting of general educational sessions regarding models of performance and transparency, and obtaining participant feedback
3. Feasibility testing and possible implementation of the BV business model in the Italian Industry

More specifically, the first goal was investigation into the use of performance and transparency models, expressly the BV business model, in the academic setting in this international university. The researcher carried this out with the assistance of the Research Group for Engineering and Systems Logistics (RESLOG) group in the Department of Engineering Management and Production at the Politecnico di Torino. The measurements and results from goal one are presented in order to determine if the goals of performance and transparency as promoted by the BV business model are achievable in an international academic setting. The specific academic setting was in the 2011 fall term Project Management (PM) course with 118 students, from more than 25 different countries, given at the Politecnico di Torino by Professor Alberto De Marco and his collaborators.

## Objective

The purpose of the ensuing simulation is to illustrate how well the BV business model is able to be taught in an international, academic course as a tool to educate students and teachers about valuable, real-world applicable project management and procurement skills. The simulation is carried out via real-world style group projects in order to promote transformational learning. The performance of the simulation and its participants are analyzed. The ensuing simulation provides a testament the following characteristics of the BV business model: 1) instructive; 2) transformational; 3) flexible; and 4) multicultural.

The main questions of the BV model immerge as:

1. Question 1: Can it be used in an academic setting; is it instructive?
2. Question 2: Will it transform student and instructor perspectives?
3. Question 3: Is it flexible enough to still produce positive results?
4. Question 4: Will it work in a multicultural setting?

The background of the course is first described, then characteristics of the BV business model in the academic simulation are discussed, followed by an explanation of the methodology of the simulation, an analysis of the performance measurements, and finally lessons learned.

## Background

The academic setting of this simulation was at an Italian University for Engineering and Architecture Disciplines with about 30,000 total students. The University is composed of a variety of engineering students from around the world, with 12% international students due to its numerous bilateral agreements and international collaboration with other universities (Politecnico 2012). The particular course targeted for the simulation was a PM course open to students in a variety of engineering disciplines, such as Industrial Engineering, Management Engineering, Mechanical Engineering, Electrical Engineering, etc. The students are typically from other similar European Academic systems, with most students at a graduate level (Politecnico 2012). The course provides higher education in the discipline of PM and is not directed at any one particular sector or field of engineering, thus it is cross-disciplinary. The large size and international composition of the university, coupled with the cross-disciplinary structure of the course made this the ideal academic setting in which to test BV concepts via a simulation.

The PM course provided students with a foundation in PM principles as outlined by De Marco (2011). Additionally, the Project Management Institute (PMI) served as a main resource of inspiration and direction on PM-related principles and content for the course. As defined by De Marco (2011), "Project Management is a professional practice involving a variety of disciplines to support the tasks required to effectively complete a project. Managerial activities include decision making, problem solving, planning, scheduling, directing, coordinating, monitoring, and control." The dominant concepts of the course were the PM fundamentals of: 1) human resources (people) and organizations; 2) financial considerations; 3) soft skills and characteristics of a Project Manager (communication, leadership, quality, integration, etc.); 4) hard skills of a Project Manager (planning, time scheduling, cost accounting, estimation, etc.); 5) measurement/monitoring/reporting techniques; 6) procurement management; 7) delivery methods; 8) cost structures; 9) award methods; and 10) uncertainty (risks and mitigation). The course consisted of formal instruction, a group project, and a final exam. The BV business model was both instructed and used in the group project to simulate a real-life project.

## Characteristics of the Simulation

The characteristics under analysis of the BV business model are reviewed and described to provide a common understanding of these principles and how they were measured.

### *Instructive*

In order to be used in an academic setting, a model must foremost be instructive and foster learning in the students. Learning is a complex process, with both internal and external sources, influences, and impacts; however, learning in the field of management is highly correlated with an "experience factor." Learning can occur by: "1) elaborating existing frames of reference (or meaning perspective), 2) learning new frames of reference; 3) transforming habits of mind; and 4) transforming points of view, which can occur if people try on another's point of view" (Kitchenham 2008). Furthermore, there are a variety of methods that are used for instruction, such as: traditional lecturing, computer simulations, internships, and information-technology (IT)

related methods; however, each has its barriers.  The students and the learning environment will be the primary decision factors as some of these methods are limited in their: degree of reality, ability to promote group related teamwork, and time constraints (Brown 2000).  The BV business model is used in this academic setting to promote learning of the course concepts via a simulation method, while not computer-based.

## *Transformative*

Two main types of learning, action and transformative, emerge which closely parallel management education.  As stated by McGill and Beaty, "Action learning is a process of learning and reflection that happens with the support of a group or set of colleagues working with real problems with the intention of getting things done" (2000).  Transformative learning is defined as "a deep, structural shift in basic premises of thought, feelings, and actions" (Kitchenham 2008).  In the field of management, projects or simulations are created as learning events.  These "experiential" learning activities are consistent with the constructivist view of learning, stipulating that the purpose of teaching is not to transmit information but to encourage knowledge formation and development (Raelin & Coghlan 2006).  The process of reflection is critical to this perspective as it is the essential link between past action and more effective future action (McGill & Beaty 2000).  Learning is therefore a process that results in a change in perspective, enabling us to handle similar or new situations in the future.  The BV business model as used in this simulation seeks to stimulate that change in perspective, through instruction (the PM lectures) and practical experience (the PM project).

## *Flexible*

In order to create both action and transformative learning in a variety of settings, in this case both industry and academic, a system must have a certain degree of flexibility.  The term "flexibility" may seem simple, yet its intuitively positive nature is a barrier to its definition in common terms and results in various generalizations.  The variety of notions, generally positive portrayal, and perceived importance of flexibility are a hindrance on its general definition.  By studying a variety of fields, such as Organizational, Strategic, and Operations Management Fellenz (2008) found that each differs in their constructs of the application of flexibility.  Additionally, flexibility is often viewed as taking place in different hierarchies or levels within an organization (Fellenz 2008, Roberts & Stockpot 2009) and realized via specific resources (Gross & Raymond 1993).  Some commonly associated characteristics of flexibility are: adaptability (Roberts & Stockpot 2009), ability to be used for a variety of tasks, responsiveness to change, and the ability to be easily transformed (Gross & Raymond 1993).  Fellenz (2008) derived a common definition of flexibility from these convergences, which will be used here as, "Flexibility is a system's capacity for variability of one or more of its characteristics."  To further explain flexibility in this context, it is important to define: 1) the focal object; 2) the variable aspect; and 3) their relationship to one another (Fellenz 2008).  For the purposes of this paper, the focal object is the BV business model, the variable aspect is the academic environment, and their relationship is described as how the BV business model adapts to the academic environment while still producing consistent, positive results.

*Multicultural*

The participants in a learning environment can be from a variety of backgrounds and have a variety of experiences, which has the potential to produce a more diverse learning experience for the participants. Variety was described as one of the key terms of flexibility and therefore can positively contribute to learning (Gross & Raymond 1993). Similar to variety in experiences, variety in origin and culture of participants has the potential produce more robust results with a global perspective. In this BV business model simulation, students and instructors participating were from a variety of countries and backgrounds thus contributing to the multicultural aspect.

**Methodology**

The degree to which learning, transformation, flexibility, and diversity in culture take place, as well as students' understanding of key concepts conveyed, should be measured to determine if a particular system or method produced a change in perspective. After analyzing thirty nine empirical studies regarding transformative learning, Taylor (1997) found the main measurement techniques of learning to be: 1) interviews; 2) observations; 3) content analysis; and 4) ongoing measurements. In his evaluations of faculty-directed management consulting projects in an MBA program in Australia and the action learning approach, Lamond (1995) utilized a 5-question survey with the following questions: 1) The subject is relevant to my career; 2) The subject has helped me grow and develop professionally; 3) I have learned to think critically; and 4) I reconsidered many of my former viewpoints. In addition to a general evaluation of material, the measurement of learning requires a student feedback mechanism, such as a survey of key questions pertinent to measure the degree to which the group project assisted in learning as well as the resultant perspective transformation. Table 1 matches each characteristic to be measured in the simulation with a description and associated metrics.

Table 1

***Best Value Model characteristics' matrix***

| Characteristic | Description | Metric |
|---|---|---|
| (I) Instructive | The instructive quality is exemplified by the degree to which the BV model facilitates the advancement in students' learning and understanding of key Project Management fundamentals. | Surveys: I-1, I-2: Students and Instructors Pre and Post Course |
| (T) Transformative | The BV model induces transformative learning by initiating a paradigm shift in students and instructors' understanding of industry perceptions/problems and behavioral concepts. | Surveys: T-1, T-2: Student and Instructors Pre and Post BV Education Session; T-3: Group Behavioral Post Course |
| (F) Flexible | The flexibility of the BV model is evidenced by its ability to be used both in academic and industry settings and its achievement of BV goals in both settings. | Surveys: F-1, F-2: Evaluators, Pre and Post Evaluations |
| (M) Multicultural | In a multicultural view, the BV model can be used internationally, with participants from a variety of environments. | Survey: M-1: Student Pre Course (demographics - type of student, nationality, and level of experience) |

## Simulation

The concepts of BV were simulated in this PM course via integration with the course project as well as into the curriculum via BV educational sessions for both students and instructors. Data to quantify the adaptive characteristics (instructive, transformative, flexible, and multicultural) of BV concepts was collected via surveys and interviews of both students and instructors prior and post both the project and BV educational sessions.

### *Description of the Course Project*

While it may be common practice for educators to require a group project of a sort from their students, this course project implemented is characterized as more of an innovative simulation than a simple project due to its following attributes:

1. Industry-inspired documents - project Request for Proposals (RFP) documents and requirements were based off of actual past projects and were transparent;
2. Positive environmental factors – groups were composed of international members, and efforts were taken towards creating an "as realistic as possible" evaluation environment;
3. Practical BV tools - an industry business model and precise tools were utilized.

The purpose of the course project was for students to enact the PM principles taught in the course to further their learning. With the additional effects of the simulation, added goals were to create a learning environment wherein students could experience a real-life simulation of a competitive bidding process and overall project phases.

### *Industry-Inspired Documents*

The scope of the project was formatted according to an industry RFP template that was modeled after a real project, which impacted the overall formatting, appearance, language, tone, and templates for attachments and exhibits. A comparison of the previous semesters' course project documents with the BV documents revealed some differences regarding clarity of the Request for Proposals (RFP), selection model, and overall mechanics of the project. The previous course project RFP was observed to be similar to a listing of technical specifications for the student teams and was more of an academic list of requirements. Students expressed lack of understanding with what was required in previous years. As a result, it was unclear what was required to fulfill the academic requirements. The proposed RFP for the BV academic simulation was created from a real-life project in order to replicate real world conditions of an industry project. As a result, students were treated more as vendors. In line with this simulation, it was required that all of the templates, attachments, and criteria be given and described to the level of detail requisite for vendors to compose a complete proposal. Moreover, the required criteria, format, and weighting were communicated at the beginning of the process.

### *Environmental Factors*

Students were permitted to select up to five group members, with each group member representing a different country. Each group was treated and acted as a "vendor" or "proposer"

for this project.  The project was first explained to the students and the Request for Proposals was released in the second class meeting (to simulate an industry "pre-bid" meeting).  Students were introduced to the scope and requirements of the project, with the instruction that as course concepts were taught, they were simulated in the group project.  Students were also notified that they would be treated as vendors instead of groups of students during all project-related meetings and discussions.  The original course project required weekly meetings in which each vendor had twenty minutes to update an instructor on their progress.

The main BV tools were followed closely as outlined by Sullivan et al. (2009) and Kashiwagi (2011).  The first specific BV tool was the Risk Assessment (RA) in which vendors would identify and prioritize the main risks on the project, and describe their solution and plan to mitigate this risk.  The second tool was the Value Assessment (VA) in which vendors identified options for increasing the value of the project and associated impacts.  The Work Plan (WP) was the third tool in which vendors were required to give an overview of their project execution plan.  Interviews were utilized as a tool in which the evaluation committee would ask those highest-ranked vendors a uniform set of five questions related to the documents submitted.  Lastly, the evaluation method served as a tool because it promoted comparative and anonymous ratings of vendors via an evaluation committee.  The previous mechanics of evaluation were unclear and required multiple spreadsheets, explanations, and strained resources.  Each student group submitted over 50 pages and an even larger electronic file with the previous evaluation method.  The BV evaluations proposed to save time by performing an evaluation of only 3 pages per each group to determine the top 40%, conducting one-third fewer presentations with a more interview format, utilizing one spreadsheet for calculations, and were anonymous to minimize subjectivity.  By utilizing these business model tools, a more holistic approach was taken.  Table 2 shows a comparison of previous documents with BV.  Even at the beginning stages, utilization of the BV business model in this course project provided:

1. Clarity – all required documents were communicated upfront, with easy-to follow descriptions and templates (RA, VA, WP, and interviews)
2. Time savings – evaluators would have fewer documents to evaluate
3. Limiting subjectivity – vendors would be evaluated without identifying information (anonymous) and would have fewer protests against the selection

Table 2

*Comparison of previous course with BV*

| No. | Previous Documents to Evaluate | BV Documents to Evaluate |
|---|---|---|
| 1 | Price | Price |
| 2 | Contract Form, Payment Scheme, and Conditions | Price |
| 3 | Cash flow | |
| 4 | Time Scheduling | Duration |
| 5 | Crashing (time cost + gantt chart) | Duration |
| 6 | Technical Report | Work Plan (WP) – 1 page |
| 7 | Project Plan (WBS, OBS, WBS/OBS, CBS) | Work Plan (WP) – 1 page |
| 8 | Risk Breakdown Structure/Risk Breakdown Matrix Techniques | Risk Assessment (RA) – 1 page and |
| 9 | Qualifications | Value Added Assessment (VA) – 1 page |
| 10 | Presentations (21 groups) | Interviews/Presentations (7 groups) |

## *Description of the BV Educational Sessions*

Educational sessions on BV concepts were held for two purposes: 1) ensure students properly understood the mentality and approach of BV and how to use it in their project; and 2) determine the possibility of incorporating BV concepts into course curriculum. Simply implementing the tools on the course project would not be enough for the students to experience more of a transformational learning experience in which they changed many of their former viewpoints. Therefore, the theory explaining BV and its concepts was conveyed to the students and instructors with the ambition to initiate a learning transformation. The topics were: the industry structure, the event model, and BV Performance Information Procurement System (PIPS) as informed by the literature (Kashiwagi 2011, Kashiwagi et al. 2009). These characteristics were measured via student and instructor surveys and interviews.

## *Survey Design*

In line with what was described in the literature, the surveys were related to measurement of the performance of the BV business model in the course project as well as the BV educational sessions. The surveys were designed to measure the characteristics of the BV business model and are named accordingly: I = instructive, T = transformative, F = flexible, and M - multicultural. The questions asked were clear and direct, as informed by the literature and the aggregated years of professional and academic experiences of the authors in Engineering and Project Management. A ten-point scale, from 1 (strongly disagree) through 10 (strongly agree) was utilized for scoring purposes. Comments were also solicited from survey respondents at the end of each survey. In analyzing the results, where there occurred a mode difference from "pre" to "post" scores greater than 2 and/or a shift from 5 or below to 5 or above (or vice versa), this was considered a significant shift and the implications were discussed. All surveys and interviews were voluntary and completed by every individual present on the day the survey was distributed.

## *Instructional, Transformative, Flexible, and Multicultural Surveys*

In the Course Surveys, I-1 and I-2, students rated their knowledge of PM fundamentals (Project Management and Contracting) and ranked their perceptions of the industry in general based on their prioritization of the most prevalent problems. For the multicultural aspect, students' demographics were taken from the survey respondents with regards to: 1) level of experience; 2) nationality; and 3) educational level. In the Course Surveys, I-3 and I-4, the instructor ranked students' understanding of PM topics from the previous year and how the course project assisted students in learning these topics as well as the instructors in teaching the topics. The course project evaluators were asked how comfortable they were with BV criteria in surveys F-1 and F-2 in order to determine the suitability of the BV criteria to this academic simulation. In surveys T-1 and T-2 students, instructors, and evaluators rated the degree to which they agreed with certain statements regarding performance and risk in the industry and also ranked their perceptions of the industry based on their prioritization of the most prevalent problems. Survey T-2 had an additional question regarding the degree to which participants had reconsidered many of their former viewpoints after this educational session. To further measure the degree to which

transformative learning takes place, students were asked to evaluate the degree to which the project and group members shaped their learning and perspectives.

## *Interview Design*

Interviews were taken from both students and instructors in order to gain qualitative feedback with the potential for improving the course in the future and integrating BV concepts. Questions that were asked were simple and provided insight into the learning process that took place in both instructors and students. Additionally, every survey had a section that solicited feedback, comments, and lessons learned from survey participants.

## **Data Analysis**

Each of the four (4) types of surveys is described below, along with an analysis of their results. Please also reference Table 1.

1. Instructional – Pre-Course (I-1) and Post Course (I-2) – Students and Instructors
2. Multicultural – Pre-Course (M-1)
3. Transformational – Pre-Educational Session (T-1); Post-Educational Session (T-2) – Students and Instructors; Post-Project (T-3) – Students
4. Flexible – Pre-Evaluation (F-1) and Post-Evaluation (F-2) – Evaluators

## *Instructional Quality Surveys*

Surveys I-1 and I-2 substantiated students' growth in understanding of key PM fundamental topics and the associated instructors' perception of their learning. Please see Table 3 for complete results. Each column corresponds to a different survey mode, with values: Pre-Course Mode, Post-Course Mode, and Mode Difference in the survey. Survey I-1 revealed that, on average, students do not have a high initial level of comfort or knowledge of the PM fundamentals presented in the course survey. Students rated the following criteria in the discipline of Project Management based on a scale of (1-10), with: I have never heard this topic before (1); I am familiar with this topic (5); I am very familiar with this topic and I would be able to teach this topic to someone unfamiliar with the topic (10). The topic the students were most comfortable with was soft skills and the topic they were least comfortable with was delivery methods. At the conclusion of the course, students' level of knowledge raised overall in comparison to the initial levels. The most significant shift was in the criteria regarding delivery methods (7), as students experienced a very large growth in understanding this principle. From the course feedback section of the survey, students were overall pleased, with feedback such as: "This course had a positive impact on me. I learned topics totally unknown for me and I really appreciate the effort of the instructors," and "I can talk about concepts that at the beginning of the course I don't even know they exist. I like the methodology."

Survey I-1 uncovered that the instructor's perception of previous students' understanding of PM topics was average (5) to high (10). For students, the survey's instructions were: "Rate the following criteria in the discipline of Project Management based on a scale of (1-10): I have never heard this topic before (1); I am familiar with this topic (5); I am very familiar with this topic and I would be able to teach this topic to someone unfamiliar with the topic (10)." For the

instructor, the survey's instructions were: "Rate the following criteria based on a scale of (1-10): The students last/this year had a poor understanding of this topic at the end of the course (1); The students last/this year had an average understanding of this topic at the end of the course (5); The students last/this year had a good understanding of this topic at the end of the course (10)." The surveys' results illustrated that there was room for improvement in the students' learning from the previous year. Additionally, the instructor indicated that the project assisted their teaching of these concepts, while still having room for improvement. In the comments, the instructor indicated that, "I have learned that I was missing the professional aspect, the past was more focused on academic things (tools, scheduling, planning). Students did not act professionally, as I had hoped they would." In Survey I-2, the instructor's perception of students' learning and degree to which the project facilitated this increased or stayed the same overall. In the interview, the instructor commented, "I observed students' understanding in procurement management, awarding methods, and the concept of uncertainty improved this year via the course project simulation." Students' grades revealed higher average scores compared to the previous year.

Table 3

***Surveys I-1 and I-2***

| No. | Criteria | Unit | Students (mode) | | | Instructors (mode) | | |
|---|---|---|---|---|---|---|---|---|
| | | | Pre | Post | Difference | Pre | Post | Difference |
| 1 | Human resources | 1-10 | 5.00 | 5.0 | 0.0 | 5 | 10 | 5 |
| 2 | Financial considerations | 1-10 | 5.00 | 5.0 | 0.0 | 10 | 10 | 0 |
| 3 | Soft skills of a PM | 1-10 | 5.00 | 8.0 | 3.0 | 5 | 10 | 5 |
| 4 | Hard skills of a PM | 1-10 | 5.00 | 8.0 | 3.0 | 10 | 10 | 0 |
| 5 | Measurement/reporting | 1-10 | 5.00 | 7.0 | 2.0 | 10 | 10 | 0 |
| 6 | Procurement management | 1-10 | 1.00 | 5.0 | 4.0 | 5 | 10 | 5 |
| 7 | Delivery methods | 1-10 | 1.00 | 8.0 | 7.0 | 5 | 5 | 0 |
| 8 | Cost structures | 1-10 | 5.00 | 7.0 | 2.0 | 5 | 5 | 0 |
| 9 | Award methods | 1-10 | 1.00 | 5.0 | 4.0 | 5 | 10 | 10 |
| 10 | Uncertainty (risks and mitigation) | 1-10 | 5.00 | 7.0 | 2.0 | 5 | 10 | 10 |
| | Number of respondents | | 94 | 87 | | 1 | 1 | |

*Multicultural Survey*

Also measured pre-course, Survey M-1 obtained students' demographics, in which students reported their educational level, nationality, and level of experience. Overall, eighty seven percent of students were Masters-seeking, and the remaining thirteen percent were Bachelor-seeking students. Overall, forty-eight percent of students had no experience at all, with thirty-three percent of students having three to nine months of experience, and nineteen percent having one year or more of experience. Figure 1 shows that the largest groups of international students came from Europe and Asia. While the university itself reported 12% international students, this course was even more of an international mix with 83% international students as only 17% of the students were stated to be from Italy (Politecnico 2012). The students represented a culturally diverse population, which was very beneficial to their learning, as noted by a student's feedback at the end of the course project, "The course has given me a broader perspective on PM and how all the pieces fit together in risk management, finance, scheduling, and resource management. The project played an important role in helping me understand the theory lectures and prepare

better for the final exam.  The multinational composition of the teams was also a great experience!  I think it was a great simulation of the real world experience!"
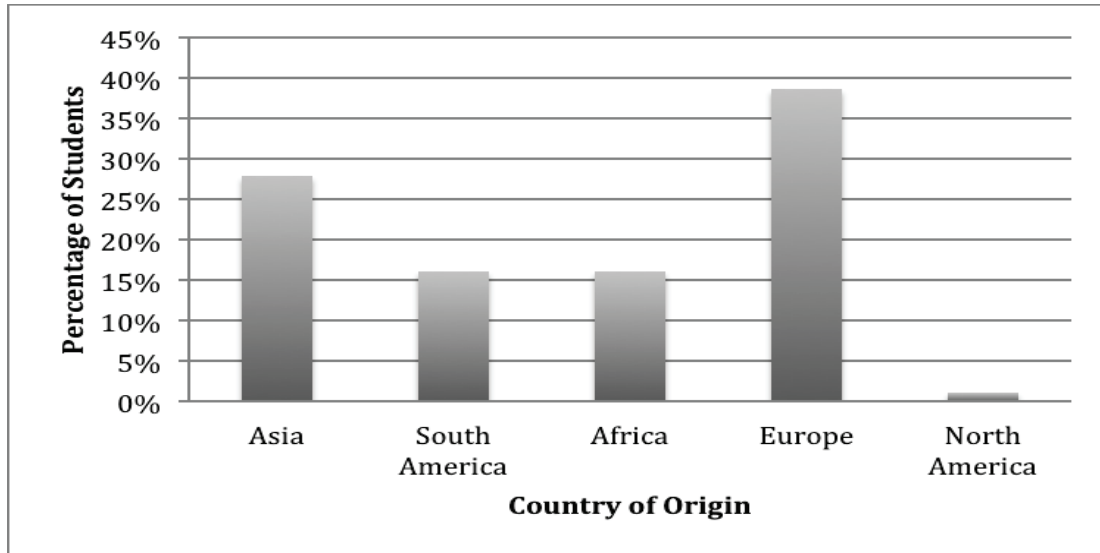


*Figure 1:* Origin of Students.

*Transformative Quality Surveys*

Surveys T-1 and T-2 displayed that there was a shift in students' and instructors' perceptions regarding performance, industry problems, and risk in the industry after attending BV Education Sessions.  Overall students and instructors experienced a corrected understanding of the industry after the educational sessions, as evidenced by their survey responses.

For the students' and instructors' complete responses, please see Table 4.  The students experienced a corrected shift in understanding that the current environment of choosing vendors based solely on price does not result in a shift of risk to that vendor (as seen in No. 4).  However, students experienced an incorrect understanding of the degree to which vendors currently pre-plan, report their risks, and level of owner management.  The cause of this misunderstanding could have been the educational nature of the session, which provided students lacking experience with industry knowledge.  Understandably, students could have mistaken the "ideal" condition in which the vendor performs pre-planning and risk management for the "current" condition with poor communication and low pre-planning observed to have taken place.  Regarding questions No. 12-16, the shift differences were varied in their prioritization of the most prevalent problems, thus conclusions cannot be properly drawn from such a varied sample.  In response to the question regarding the degree to which participants had reconsidered many of their former viewpoints after this educational session (No. 11), students mostly agreed with the statement (mode value of 10, average value of 7). This is significant because it illustrates that a transformative shift took place in the students' perspectives regarding performance and risk in the industry.

For the instructors and evaluators' complete responses, please see Table 4, instructions were given as: "For #1-11, please rate each of the criteria based on a scale of (1-10) with "10" as strongly agreed and "1" as strongly disagreed.  Please rate each of the criteria to the best of your knowledge.  For #12-16, please rank in order according to your perception of the prominence of the problems most prevalent in the Market (1 being top and highly prevalent, 5 being bottom)." The instructors and evaluators experienced a correct shift in understanding that performance in the industry is declining (No. 1); the current environment of choosing vendors based solely on price does not result in a shift of risk to that vendor (as seen in No. 4).   However, instructors and evaluators experienced an incorrect understanding of the degree to which vendors currently report their risks (No. 6), similar to the students' responses.  The cause of this misunderstanding could have been the educational nature of the session, which provided instructors and evaluators lacking experience with industry knowledge.  Understandably, instructors and evaluators could have mistaken the "ideal" condition in which the vendor performs risk reporting for the "current" condition with a low amount of observed risk reporting to have taken place.  It could be said that those participants lacking industry experience simply confused their preconceived notions or the "ideal" condition with reality due to their gap in experience.  Also, it is possible that the educator did not properly denote the differences between the ideal condition of proper risk reporting and the vacant current industry practice of reporting, affecting the students' perceptions as well. Regarding questions No. 12-16, the shift differences were varied in their prioritization of the most prevalent problems, thus conclusions cannot be properly drawn from such a varied sample. In response to the question regarding the degree to which participants had reconsidered many of their former viewpoints after this educational session (No. 11), instructors and evaluators mostly agreed with the statement (mode value of 8, average value of 7). This is significant because it illustrates that a transformative shift took place in the instructors and evaluators' perceptions regarding performance and risk in the industry.

Table 4

*Surveys T-1 and T-2*

| No | Criteria | Unit | Correct | Students (mode) | | | Instructors/Evaluators (mode) | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Pre | Post | Difference | Pre | Post | Difference |
| 1 | Construction performance in the industry is declining | 1-10 | 10 | 5 | 7 | 2 | 5 | 8 | 3 |
| 2 | In the current market, Owners are required to expend more effort managing vendors | 1-10 | 1 | 5 | 1 | 4 | 7 | 8 | 1 |
| 3 | Low-Bid environment results in high quality | 1-10 | 1 | 3 | 1 | 2 | 2 | 1 | 1 |
| 4 | Low-Bid environment shifts risk to vendor | 1-10 | 1 | 7 | 1 | 6 | 8 | 1 | 7 |
| 5 | Proper and sufficient Pre-planning is performed by the majority of vendors | 1-10 | 1 | 5 | 7 | 2 | 2 | 2 | 0 |
| 6 | Vendors utilize a risk reporting mechanism | 1-10 | 1 | 5 | 8 | 3 | 1 | 5 | 4 |
| 7 | The majority of risks cannot be foreseen before they happen | 1-10 | 1 | 3 | 2 | 1 | 2 | 4 | 2 |
| 8 | Changing project delivery methods will mitigate a majority of the risks | 1-10 | 1 | 5 | 5 | 0 | 5 | 5 | 0 |
| 9 | The majority of risks are uncontrollable | 1-10 | 1 | 3 | 3 | 0 | 2 | 2 | 0 |
| 10 | Circle the real source of expertise in the construction industry (1 = owner; 2 = vendor; 3 = designer) | 1, 2, or 3 | 2 | 2 | 2 | 0 | 2 | 2 | 0 |
| 11 | I have reconsidered many of my former viewpoints after this education | 1-10 | 10 | n/a | 10 | n/a | n/a | 8 | n/a |
| 12 | Low bid/ Emphasis on price | 1-5 | n/a | 5 | 2 | 3 | 2 | 2 | 0 |
| 13 | Corruption | 1-5 | n/a | 1 | 5 | 4 | 5 | 1 | 1 |
| 14 | Not paying on time | 1-5 | n/a | 4 | 4 | 0 | 1 | 2 | 2 |
| 15 | Over-budget | 1-5 | n/a | 5 | 2 | 3 | 2 | 3 | 3 |
| 16 | Lack of Pre-planning | 1-5 | n/a | 1 | 1 | 0 | 3 | 2 | 2 |
| 12 | Low bid/ Emphasis on price | 1-5 | n/a | 5 | 2 | 3 | 2 | 2 | 0 |
| Number of respondents | | | | 72 | 45 | | 7 | 6 | |

To further measure the degree to which transformative learning took place, the Post Behavioral Group Survey (T-3) was distributed upon students' completion of the project. Please see Table 5 for complete information. The instructions were: "This portion is regarding the course project you completed for this course. Rate each of the criteria based on a scale of (1-10) with "10" as strongly agreed and "1" as strongly disagreed. Please rate each of the criteria to the best of your knowledge." The surveys revealed that project group members agreed that they experienced a transformative shift in their learning. Students reported that they are better able to think critically, have reconsidered many of their former viewpoints, and group members shaped their

learning and perspectives.  This is significant because it substantiates the transformational effects BV can have.  Additionally, students' comments revealed:

- "I know more the every phases and activities of project and at the same time the teamwork spirit also made me feel more professional."
- "In my opinion, the project showed a different way to learn.  I liked it very much because it was the first time in the Master of Science at the Politecnico that I made a practical job."
- "Personally I was the project manager of my group and this had increased in a good way my level of knowledge in this field.  It has been one of my favorite courses that I have ever had."

Table 5

### Survey T-3

| No. | Criteria | Unit | Post (mode) |
|---|---|---|---|
| 1 | Project Management is relevant to my career. | 1-10 | 8.0 |
| 2 | The project has helped me grow and develop professionally. | 1-10 | 10.0 |
| 3 | I have learned to think more critically as a result of this project. | 1-10 | 8.0 |
| 4 | I have reconsidered many of my former viewpoints after this project. | 1-10 | 7.0 |
| 5 | My group members have contributed to my learning. | 1-10 | 10.0 |
| 6 | I feel more confident in my knowledge of Project Management after completing the project. | 1-10 | 8.0 |
| | Number of respondents | | 87 |

### *Flexible Quality Surveys*

Surveys F-1 and F-2 illustrated that evaluators initially understood the BV criteria implemented on the course project (RA, VA, WP, Interviews, and Evaluation Process) and their satisfaction was overall positive.  Please see Table 6 for the complete dataset of average scores.  The instructions were: "Pre: Rate each of the following criteria based on a scale of (1-10) with "10" being highly understood and "1" being completely misunderstood.  Post: Rate each of the following criteria based on a scale of (1-10) with "10" being highly satisfied and "1" being very dissatisfied."  Comparing Survey F-1 with Survey F-2, evaluators were more satisfied with the BV criteria; however, they expressed some concerns with the WP and Interviews.  This suggests that there is a key difference between developing an understanding of a concept and applying that concept successfully, implementation can be challenging.  Their initial comments showed that they were uncertain with their abilities to properly evaluate the documents; however, this was addressed with two simple workshops that were held for evaluators to evaluate similar sample documents and review them in order to practice the evaluation process.  In survey F-2, the comments revealed that the WP may not be a useful tool because students had difficulty composing an overview of their projects.  Furthermore it was suggested that more time and questions be added to the interview sessions.  However, this was not feasible due to the availability of the evaluators, quantity of groups, and timing of the course.  Evaluators were highly satisfied with the RA and VA approach, as one commented that this was a concise and dominant way to organize this information that would have been lost in previous year's project documents.  As a final transformative question, the evaluators were asked if they revised their former viewpoints regarding evaluations, to which they overall replied positively.

Table 6

***Surveys F-1 and F-2***

| No. | Criteria | Unit | Evaluators (average) | | |
|---|---|---|---|---|---|
| | | | Pre | Post | Difference |
| 1 | The RAVA process overall | (1-10) | 7.8 | 9.0 | 1.3 |
| 2 | The Work Plan process overall | (1-10) | 9.3 | 7.8 | -1.5 |
| 3 | The interview process overall | (1-10) | 8.5 | 8.3 | -0.3 |
| 4 | The evaluation process overall | (1-10) | 8.0 | 8.5 | 0.5 |
| 5 | The BV process overall | (1-10) | 8.0 | 8.5 | 0.5 |
| 6 | I have revised many of my former viewpoints regarding the process of evaluating ("1" for disagree and "10" for agree) | | | 8.3 | n/a |
| | | Number of respondents | 7 | 7 | |

## Results

BV concepts are instructive, transformational, flexible, and multicultural. This was proven via the course assessments, surveys, and interviews. Returning to the initial questions (1-4), it is found that all can be responded to with a positive reply.

*Question 1: Can BV be used in an academic setting; is it instructive?*

Yes, students reported an increase overall in their understanding of course concepts at the end of the course. Post BV educational sessions, students' scores illustrated an increase overall in understanding of BV concepts and movements toward comprehension of the goals of performance and transparency. Both students and instructors agreed that the BV business model improved their understanding of procurement management, delivery methods, award methods, and risk. In an interview, the instructor commented, "Students are stronger in these processes and understand better bidding, how competition can be overcome by vendors' actions, and no longer perceived procurement from a clients' perspective." Furthermore, a student stated, "According to me, the project practice made me know more about the skills of project management and through all the process of the project." As a result, frames of reference and perspectives were improved.

*Question 2: Will it transform student and instructor perspectives?*

Yes, student and instructor perspectives were transformed as displayed in the interviews and surveys. Upon completion of the simulation, a student reflected in stating: "One thing that I realized recently is that the teams working are very variable, working here with very capable teammates was a really growing experience. The knowledge about the management of one project to me now is very different in respect to the beginning of the course. Now I know that management is a really deep area of knowledge and is important to accomplish any target professionally or maybe personal too." The instructor reflected similarly in an interview by saying, "At the beginning, I was concerned with the following: decreasing emphasis on academic requirements, documents to be evaluated were not representative of the vendors' total capacity,

and using non-technical evaluators to evaluate the proposals.  However, after completing the simulation I am surprised that these did not impact the overall outcome, my concerns vanished, and I am completely satisfied."  Additionally, students, instructors, and evaluators all positively responded that "I have changed many of my former viewpoints" in a variety of surveys.  The FS and the instructor are modifying the course next year for future implementation of BV concepts into the course curriculum and the project as a result of the simulation.

*Question 3: Is it flexible enough to still produce positive results?*

Yes, the BV business model was capable to vary in its environment and variables, yet still the projects and the overall simulation saw positive results:

1.  Reduction of time to evaluate by 50% overall
2.  Reduction in student disputes with grades by 75% overall
3.  Improvement of students' grades measured from the previous year
4.  Overall satisfaction of the execution of the project by the instructor 10 out of 10 (20% improvement from last year)

*Question 4: Will it work in a multicultural setting?*

Yes, students were from more than 25 different countries (83% non-Italian) with a variety of experiences and all worked together in teams utilizing the BV business model.  In addition, the course instructors and evaluators (7) were from 3 different countries.

**Conclusion**

BV instruction promotes a movement towards transformative learning at the core of its theory, called the Cycle of Learning, with its similar stages of information: 1) perception; 2) processing; 3) application; and 4) change (Kashiwagi 2011).  This transformative learning takes place in those that apply the BV system, both instructors and students alike because they: 1) perceive information that they did not originally observe; 2) process this new information, realizing that their actions can cause change; 3) apply the concepts, acting as a change agent; and 4) take action for change in greater contexts (Kitchenham 2008).  In summary of the measured qualities of BV:

1.  The instructive quality of the BV model was displayed via the students' and instructors' measured educational performance difference.  The BV model is utilized by the industry in real-world applications, thus the instruction promoted learning about the field of PM.
2.  The transformative quality was seen in the students' and instructors' survey responses that they have changed their perspectives, interview quotations recognizing a shift, and course curriculum changes.  The concepts in the BV model caused the students and teachers to rethink their current beliefs and develop more accurate and realistic understanding of the industry via transformative learning, and the simulation further helped the students and teachers to realize this via action learning.
3.  The flexibility quality of the BV model was illustrated on two levels:
    a.  The students gained direct knowledge, which they perceived of value in their

> future PM careers.
>
> b. The course was easier to run, evaluations took less time, and thus achieving similar results that the industry has seen in application of the model (time savings, ease of use, utilizing key information) were obtained in this academic simulation.
>
> 4. The multicultural quality was seen as BV concepts were readily adapted in a multicultural situation, with varying backgrounds of the students and the instructors, and the simulation was successful.

BV is more of a business model than a specific procedural model. Based on this reported experience, the BV model has proven to be a holistic approach in an academic setting. This simulation has demonstrated:

1. BV business model could be used in course simulations with results such as: increased transparency, consistency in application by the instructor with this easy-to-follow business model, creation of a more "real-world" simulation for students, more effective evaluation techniques, and increased student learning of BV concepts;
2. BV concepts can be implemented into the curriculum with results such as: better understanding of industry problems, clarity of concepts, and increased practical understanding;
3. Efficiency - The BV model increases or promotes more efficient performance by providing time savings and allocation of scarce resources;
4. Transparency – The BV model stresses requirements that are clear and open;
5. Quality - the culmination of the utilization of the BV model is an increase in quality of the finished product, better results than previous years or projects.

The sustainability of the BV business model in an academic setting must also be addressed in the next phases of implementation. The group is currently looking towards other testing carried out internationally in Botswana and the Netherlands (Adeyemi et al. 2009, Koreman 2011, Kashiwagi et al. 2009). Modifications to the course curriculum and project for next year are being investigated and will likely adopt many of the BV concepts into the course.

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