

# Direct Assessment of IS Student Learning Using an Integrative Exercise

**Lynn J. McKell**

**Gary Hansen**

**Conan Albrecht**

Information Systems Department

Brigham Young University

Provo, Utah 84602

[mckell@byu.edu](mailto:mckell@byu.edu) [gary\\_hansen@byu.edu](mailto:gary_hansen@byu.edu) [conan\\_albrecht@byu.edu](mailto:conan_albrecht@byu.edu)

## ABSTRACT

The assessment of learning objectives has become an important element in the improvement and accreditation of academic programs, including information systems (IS). Indirect assessments have been common in these endeavors, but direct assessments have been sparse. In the first semester at Brigham Young University (BYU), IS students take four “integrated core” IS courses simultaneously. In an effort to assess the students’ comprehensive learning the last week of the semester in all four courses is dedicated to a comprehensive, cross functional **integrative exercise** (INTEX): a very intensive, group case exercise that requires student teams to apply IS and other business skills. Case deliverables include a formal presentation of an IS solution, a large set of documentation including use cases and data models, and a passive prototype of some system elements. Team work is essential to achieving acceptable results. Together with representatives from a leading industry consulting firm (who usually fly in for the event), faculty and graduate students assess the presentation and supporting materials. This direct assessment is a significant element in the grade for all four core courses. Though students find the INTEX to be intense, feedback from graduation exit interviews suggests it is one of their most valuable learning experiences. This paper explains the structure of the INTEX and its benefits to IS majors.

**Keywords:** Curriculum Integration; Direct Assessment of Learning Objectives.

## 1. INTRODUCTION

The BYU Marriott School offers a curriculum for students to pursue a Bachelors degree in Information Systems (IS) through the business school. The curriculum is designed for students to take four “core” courses simultaneously during their first semester in the IS major: (1) Principles of Business Programming, (2) Information Systems Analysis, (3) Database Systems, and (4) Enterprise Services and Security. The integrated core (or “core”) was introduced because many BSIS students were not able to integrate IS topics like programming, database, analysis, and design together in the traditional model (where students are “thrown over the wall” from one IS class to another). Since the introduction of the core, student performance on national exams and student feedback has improved markedly. Faculty teacher ratings have improved, and the classroom environment and culture has been enhanced.

The capstone event of the core--now seen as a “rite of passage” by students--is an exercise given during the last week of the semester. During this week, class sessions are canceled in the four core courses and the time is dedicated to a comprehensive cross functional **Integrative Exercise** (INTEX) which requires student teams to apply skills in IS

as well as in other business subjects, such as accounting, finance, operations, communications and team building. The deliverables are a formal presentation of an IS solution, a large set of documentation including use cases and data models, and a working prototype of a system solution module. Obviously, there is far more work to be done than one person can accomplish; team work is essential to achieve acceptable results. During the awards ceremony, student often comment on how much they were able to accomplish in the short week.

We now have a history of experience with this process. This paper explains the structure of the INTEX and aspects of its evolution including: a brief description of the cases used, a description of material given to the student teams, a description of deliverable expectations including the team presentation, a description of the evaluation forms and process which includes faculty and professional evaluations and student peer evaluations, and a summary of follow-up feedback from the students. Though students find the INTEX to be an intense educational experience, feedback derived from post evaluation and graduation exit interviews suggests that it is one of their most valuable learning opportunities.

## **2. OVERVIEW**

As the name INTEX (INTEgrative EXercise) suggests, it is intended to encourage students to look at the “big picture” of the systems development process in the context of a business case. Most students involved in INTEX have taken a solid core of accounting, finance, communications, economics and other business classes prior to the systems core. INTEX is the culmination of the four information systems core areas taught in the first semester of the IS foundation curriculum. Students are advised at the orientation session (held at the beginning of the semester) and reminded periodically that the final week of the course (with significant impact on their grade) will consist of the INTEX project. They are required to participate, and they are asked to plan family and work activities accordingly so the week is free. Using both hard copy and the Internet, general information (including the assignment of student teams) is distributed a week prior to beginning the INTEX so that student teams can meet and work out schedules.

INTEX is scheduled for six days between Monday afternoon and Saturday morning. The case and related instructions are distributed at a general information meeting held on Monday morning. Teams hand in their printed document packet early Friday afternoon (so the documentation can be reviewed and graded before Saturday presentations) and copies of their presentation notes at the time of their presentation on Saturday morning. This mitigates any perceived advantage for teams scheduled to present later in the morning.

The INTEX case describes the operations of a small company or a segment of a large company with various problems. During the week teams analyze the assigned case; the document packet should include problem definition and needs analysis, systems specifications, solution recommendation, feasibility analysis, return on investment with time and cost estimates, general and detailed design, implementation and conversion strategies, and passive prototypes for selected elements of the solution. The analysis also includes a project development plan expressed in part using Microsoft Project software and various process and data diagrams using appropriate documentation software. During the years of our experience the development methodology has shifted from the traditional structured approach to an emphasis on object oriented approaches using UML (Unified Modeling Language) conventions.

INTEX student groups are viewed as consulting teams, and the context of the presentation is the consulting team giving a major “professional dress” presentation of a proposed solution to corporate management. “Corporate management” is an evaluation group consisting of professors, advanced graduate students, and professional IT people (generally one of each making evaluation teams of three individuals). All presentations are given on Saturday Morning and are finished by noon. Evaluators use a common score sheet to record their ratings of the presentation and documentation. While the students have a pizza lunch, faculty members review the scores and select first, second and third place winners. INTEX score results constitute 10% of the grade for each student in each course. In addition,

presentations are taped and students are assigned to review and write a critique of their presentation.

The exercise finishes with an debriefing and awards ceremony with prizes provided by the consulting firm. As previously mentioned, for several years the case has been provided by an international consulting firm based on an actual current project. This often has permitted an extraordinary review - during the debriefing session representatives from both the consulting team and the host company were able to comment on the problem and the solution. This provided dimensions of reality, urgency and interest that are rare in a comprehensive case.

## **3. CASE DESCRIPTION**

The INTEX cases describe operational aspects of a small company (or a division of a larger company) with various problems. For example, one case described a dehydrated food processing company which had problems in accounts payable, accounts receivable and inventory management. Other case examples are a sports equipment retail company, a regional airline system, and the sales and customer service functions for a major corporate awards company, etc. Some case descriptions included financial information; identifying some problems depends upon properly analyzing the financial statements to establish that the corporate ratios are out of line with industry averages - suggesting that something could be done to improve company performance. Case materials generally contain considerable descriptive detail about accounting and operating procedures, forms and their distribution, personnel and their job descriptions, operational reports, etc. The detail is sufficient for teams to do process and data analysis, object modeling, etc.

The overarching similarity between the cases used each year is the need for a new system. Students are generally required to design new use cases and a database model, propose new hardware, devise a software development schedule, set up controls on the new system, and show example screen shots. All of these topics come from the four courses taught during the semester.

Securing cases with the right structure and appropriate amount of detail is perhaps the most difficult administrative aspect of the INTEX. We have used cases developed from consulting projects done by faculty members; also, professional consulting firms have provided a written description of recent projects they have worked on. In every case the scenario has been drawn from a real business situation. Our cases have been “fresh” each year, though it is conceivable to keep a portfolio of cases (at least three or more) available to rotate each year with enough intervening time so that case solutions are not passed down to younger classmates.

## **4. STUDENT HANDOUTS**

Prior to beginning INTEX, students are given a Preliminary Information sheet containing:

- A general brief overview of the INTEX process.
- A Reminder of grading implications.
- A Schedule of meetings students should attend - including the final presentation.

- Information about student assignments to teams.
- A Recommendation for teams to meet prior to the INTEX launch.

At the INTEX launching meeting students are given a packet containing:

- Information on the scheduling/timing parameters.
- General charge including - a brief description of expectations and deliverables.
- A reminder of the various evaluations.
- A copy of the Peer Evaluation Form to be completed and turned in at the end.
- A copy of the case.

## **5. MULTIDIMENSIONAL INTEGRATION**

Although INTEX is a capstone event for first-semester IS courses, successful teams need to draw upon skills from many business and IS related disciplines. For example, finance and accounting skills are necessary to analyzing financial statements. Accounting skills are useful in understanding various cycles (sales-receipt, acquisition-payment, inventory - production) and the details of various transaction processing and information operations. In addition, auditing skills can be useful in diagnosing control weaknesses in current systems procedures. Operations Management knowledge is helpful in understanding, analyzing and developing alternatives for production and inventory management. Logistics considerations such as acquisition, storing and distribution factors are included. Human Resource considerations factor into organizational structure, job descriptions and the personnel pressures. Marketing issues may surface in some cases. Team work, coordination, communication, conflict resolution, leadership, etc. are aspects of the team assignments. Writing skills are practiced in preparing the final report/documentation. Communication skills are used in preparation and delivery of the presentation. Project management skills are used in doing INTEX and in the proposed solution. Peer Evaluation provides exposure to another aspect of the real world.

## **6. DELIVERABLES**

From the foregoing description it is apparent that the INTEX is a comprehensive exposure to a real world problem. Depending on the specific case, in the total package of deliverables, teams are expected to show strong evidence of the following work:

### **6.1 Significant Feasibility Analysis.**

For cases with robust financial data using standard financial ratios, and comparing the case company with industry averages it may be possible to identify areas of weak performance where improved information systems could improve profitability. Student estimates for return-on-analysis are usually all over the map because of their lack of real-world experience, but the process they use is useful.

### **6.2 Thorough analysis of current operations.**

Process and data models of current operations are helpful in understanding the existing system. Students have the

opportunity to address control issues, though this is generally not a focus of the project.

### **6.3 Comprehensive proposed solution.**

Process, data and object models (use case and sequence diagrams) of the proposed system provide a general framework for understanding a new solution. This is augmented with passive prototypes of forms, input screens, reports, control/menu screens, data structures, data bases, etc.

### **6.4 Project Management and Implementation Plan**

Though generally limited, teams often use PERT charts to describe the implementation and conversion process and time frame.

A focal point of the INTEX activity is the team presentation on Saturday morning. The presentation scenario is a meeting where the outside consultants (student team) is giving its project report to the organizational top management (evaluation group – consisting of the outside professional, faculty member, and graduate student). The team presentation is given in a one hour time period: typically 20-25 minutes for the presentation, 10 minutes for questions, 10 minutes for evaluators' deliberation (the team is dismissed during this activity), 10 minutes for feedback. Five minutes are allowed for evaluators to move from one presentation venue to the next team presentation room. Presentation rooms are equipped with a computer and LCD projector.

At various times we have required students to submit two evaluation documents. One focuses on the overall INTEX experience. This form requests general feedback about the INTEX experience, including comments on problems, team dynamics, learning experience, number of hours spent on the project, etc. The second document focuses on peer evaluation of team members and allows differentiating individual performance levels by allocating participation points to each member of their group. The faculty has been less inclined to use this self evaluation in recent years.

## **7. GRADING PROCESS AND TEAM AWARDS**

Scoring: Each team receives a total team score from its evaluation group consisting of five components adding up to a possible 100 points. Four components worth 80% are evaluated based on the solution documentation using the INTEX "Scoring Sheet (See Figure 1);" The four "Scoring Sheet" sections are "Project Notebook" (10%), Project Management and Recommendations (15%), Database Solution (20%) and Systems Analysis and Prototype (35%). The fifth scoring component (worth 20%) is determined by the evaluation group based on the presentation (See Figure 2 – INTEX Presentation Evaluation Sheet). Typical team scores range from 75 to 96 (100 points possible) with the target average being 88.

Team Awards: Subsequent to the presentations, faculty and professionals meet together to ladder the team scoring results - referring where necessary to project dictionaries to insure consistency. At the debriefing meeting the top three teams are announced and awards (donated by the consulting

Evaluator Name \_\_\_\_\_ STUDENT TEAM NUMBER \_\_\_\_\_

**Project Notebook (10 points possible)**

Items for grading	Points	Score	Comments
1. Overall "look and feel"	3		
2. Organization and flow: Exec Summary, TOC, Sections	2		
3. Figures and Diagrams	2		
4. Grammar and writing	3		

Total \_\_\_\_\_

**Project Management and Recommendations (15 points)**

Items for grading	Points	Score	Comments
1. Problem Description and Scope Definition	4		
2. Cost/Benefit Analysis and Feasibility	3		
3. Project Schedule and Project Organization	4		
4. Recommendations for Solution and Approach to development/Implementation	4		

Total \_\_\_\_\_

**Database Solution (20 points possible)**

Items for grading	Points	Score	Comments
1. Conceptual Class Diagram: See attached diagram	15		
2. Relational DB Schema: See attached solution	5		

Total \_\_\_\_\_

**Systems Analysis + prototype (35 points)**

Model	Points	Points	Comments
1. Event Table (Required)	8		
2. Use Case Diagram & Use Case Descriptions (Required)	8		
3. System Sequence Diagrams and/or Activity Diagrams	9		
4. Menu Hierarchy, Sample Screens and Reports	9		

Total \_\_\_\_\_

**Figure 1 – INTEX Scoring Sheet**

firm) are distributed. Recent awards consisted of a certificate and a prize: a sweatshirt or briefcase bag for members of the first place team, a T-shirt for second place, and a sleeve of golf balls for the third place team members. As an added bonus, the professional firm will guarantee a job interview to first place team members.

In addition to regular placement awards and the case debriefing, fun awards like "largest packet" (called the tree destroyer award), "highest cost estimate" (called the starving students award), and "prettiest GUI award" are given. These awards add an element of humor to the debriefing meeting.

**8. STUDENT FEEDBACK RESULTS**

Students are generally requested to complete an INTEX Evaluation which provides valuable information for assessing the INTEX effectiveness and securing ideas for future improvements. Typical themes from this feedback include:

1. Students felt the concentrated team work was a valuable experience.

2. Students were most frustrated with group scheduling problems.
3. Students wanted more specific guidance and more time. [These were intentionally limited.]
4. Many groups wished they would have spent more time on the presentation.
5. 82% of the felt the INTEX was a valuable learning experience. Generally, INTEX helped students better understand the integration of their curriculum topics.
6. Students spent an average of 32 hours on the case.

In addition to the survey data, student comments on survey forms provide anecdotal evidence of the usefulness of INTEX. Not all students like INTEX, but the significant majority usually report it was the best experience of the semester. The following examples are typical of most comments about the event:

- "Intex I was the most valuable learning I'd ever had"
- "KEEP IT And KEEP IT HARD!!!"
- "Yes, it was hard. Yes, it was a killer, but we were warned from the beginning that it was so... You can't tell me that a situation like this never happens in

<b>Evaluator Name</b> _____	<b>STUDENT TEAM NO</b> _____
Group Presentation	25 minutes (Student Group Presents)
Question/response	10 minutes (Evaluators ask questions)
Evaluation Team Deliberation	10 minutes (Student Group exits the room)
Feedback	10 minutes (Student Group called back into room)
Break/Setup	5 minutes (Group exits; next group sets up)

**Presentation (20 points)**

Suggested Items for grading	Points	Description	Score	Comments
Content – Organization	5	Clear, complete, accurate. Well organized. Easily understood. Right balance of “vision” versus detail. Salient points were easy to grasp. Presentation flows well.		
Content – Credibility/ Conclusions	5	Did they convince you to buy? Adequate support for their recommendations. Conclusions are realistic and convincing. Understand controls issues		
Content – Questions	2	Audience questions were handled well with convincing detail.		
Presentation – Preparation	3	Dress, appearance, Setup. Show confidence.		
Presentation – Delivery, time, visual aids, etc.	5	Energetic. Dynamic. Not boring. Good balance between members. Good switch between presenters.		
Adjustments to content – Either + or – to notebook score	Any thing	If, after the presentation, the evaluators want to adjust the score on the notebook, either up or down, feel free to do so.		
		<b>PRESENTATION TOTAL</b>		

**Figure 2 – INTEX Presentation Evaluation Sheet**

the workplace. Now I have experience that I can work under pressure. I can perform when such a task is brought upon me. I'll draw from that experience for a long time.”

- “Great experience, but sleep would have been nice :)”
- “I really hated Intex at times during that week. But looking back, it was the best experience of the semester. By giving a project that required all of the skills we had gained in the previous semester into one big project really made me realize what I could and couldn't do. The IS Core would not be as good as it is without it.”
- “Definitely do it! I heard many comments that INTEX is where many topics finally clicked for the students.”
- “Getting opinions from professionals in the industry was invaluable and should continue in the future.”

**9. INTEX CRITICAL SUCCESS FACTORS**

There are several key aspects of the INTEX activity which contribute to its effectiveness. These include:

1. The INTEX case is derived from a real problem in a real organization.
2. The same case is used by all student teams. This permits scaling INTEX to meet a variable number of students with limited faculty resources.
3. The INTEX case scope spans topical material from

all four IS core courses taken during the semester, and imposes a severe time constraint which requires a team approach.

4. The presentation scenario, including an outside professional in the “management group,” effectively promotes a professional atmosphere for the INTEX experience.
5. The follow up address by an actual officer from the real organization has enhanced the learning aspect of the INTEX experience.

**10. SUMMARY AND CONCLUSION**

INTEX has been a part of the BYU IS curriculum for over a decade. While the basic model and structure have been consistent, the activity has evolved somewhat – the most notable changes being (1) greater involvement of a national consulting firm in recent years to provide the case and inclusion of both consultants and clients in the debriefing session, and (2) development of INTEX 2, a project-based assessment activity similar to INTEX applied to the second set of four courses taken during the second semester of the “core” curriculum program.

As noted, INTEX received a very favorable (82% positive) rating by students even though it was generally considered intensive. Consistent with this assessment, the faculty also felt that INTEX was a valuable experience, and

its continuation with comparable cases is planned for use in the future. IS faculty are confident that INTEX not only yields greater understanding of the information systems development process, but also gives deeper insight into accounting and business functions, procedures and ways of analysis. Nevertheless, the administrative tasks for faculty and the burden on students should not be underestimated.

There are other ancillary benefits worth mentioning. First, this is an exercise which requires participation by virtually the entire information systems faculty, and thus serves as a common experience to enhance collegiality. Second, the departmental cooperation with primary recruiters has been further enhanced by working together on the INTEX. Third, often when recruiters ask students to describe a team building activity or difficult problem solving experience, a student may use the INTEX as the basis for their response. Recruiters are favorably impressed by the depth and intensity of the activity. Fifth, by involving advanced graduate students as part of the evaluation team, these students experience a useful review and see the systems development process from a somewhat different perspective. Sixth, the INTEX activity provides specific feedback to team members highlighting strengths and weaknesses of their work.

INTEX is a major direct assessment activity. Though the focus is on individual and team assessment, faculty get qualitative evidence of whether or not the IS curriculum is achieving program objectives. An explanation of INTEX and examples of typical project notebooks are included in the departmental assessment evidence portfolio used in the accreditation process.

#### AUTHOR BIBLIOGRAPHIES

**Lynn J. McKell** is a Professor of Information Systems and Certified Computing Professional at Brigham Young University. He researches information systems education and institutional program assessment.



**Gary W. Hansen** is an Associate Professor of Information Systems at Brigham Young University. He currently researches database concepts, languages, and design. He is the author of *Database Management and Design*.



**Conan C. Albrecht** is an Associate Professor of Information Systems at Brigham Young University. He researches computer-based fraud detection techniques, ecommerce platforms, and online group dynamics. He is the author of *Fraud Examination*.



Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.