

STUDENT OUTCOME ASSESSMENT: A COMPREHENSIVE COLLABORATIVE ASSESSMENT PROCESS BETWEEN INDUSTRY AND THE DEPARTMENT OF INDUSTRIAL TECHNOLOGY AT THE UNIVERSITY OF NEBRASKA AT KEARNEY

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INTRODUCTION

The primary mission of the Industrial Technology (ITEC) Department at the University of Nebraska at Kearney (UNK) is to equip its graduates with the knowledge, skills, and values commensurate with the competencies identified to become a professional in Industrial Technology with the ability to orally and visually communicate these competencies to their constituencies. Our clients are our students and industrial partners who support the programs and hire the graduates. The industrial partners are considered to be a fundamental component of the programs whose opinions are valuable and taken quite seriously. Current ITEC degree programs include Aviation Systems Management (ASM), Construction Management (CM), Industrial Distribution (ID), and Telecommunications Management (TM). As the authors are professors in the ID program, this article relates most closely with that program.

For the ITEC Department to discern if it is succeeding it conducts direct and indirect assessments to verify the continued viability of the programs and the success of its graduates. This is rooted in the faculty held belief that you cannot improve upon that which you cannot measure. Assessment measures are the vehicle upon which improvement is nurtured.

Assessing the quality of the ITEC Department's programs through an ongoing evaluation and assessment process is mandated by the North Central Association and the National Association of Industrial Technology (NAIT) [1]. The ITEC Department is accredited by NAIT.

As with any organization, it is good practice to constantly evaluate oneself to remain up-to-date and competitive. The Department of Industrial Technology not only considers itself as part of the College of Business and Technology, an institution of student learning, but a business as well. Our programs are not part of the general studies curriculum and as such we exist only to the extent that business and industry recruit and hire our graduates. Our product is our graduates and one of the most important assessments of our product is to the degree which they are recruited, hired, and retained by our industry partners. The ITEC Department boasts a placement rate that approaches 100 percent.

ASSESSMENT BACKGROUND

Assessment or accountability of educational programs is not a new concept and has gained prominence in higher education during the past couple of decades [2]. At least as far back as the Morrill Act of 1862, annual reports were required to demonstrate to stakeholders' money being utilized for higher education is being spent wisely and effectively. Section 5 paragraph 4 of the Morrill Act of 1862 (*12 Stat. 503*) states:

“An annual report shall be made regarding the progress of each college, recording any improvements and experiments made, with their cost and results, and such other matters, including State industrial and economical statistics, as may be supposed useful; one copy of which shall be transmitted by mail free, by each, to all the other colleges which may be endowed under the provisions of this act, and also one copy to the Secretary of the Interior.” [3]

Since this is the very act that established the Land Grant Universities including “such branches of learning as are related to agriculture and the mechanic arts” [3], assessment of engineering and technical programs should not be foreign to those

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engaged in the teaching of these subjects. While the concept is not new, the formal processes which are employed certainly have been refined over time.

A quick review of relevant accrediting associations also reveals strong support for assessment. The Accreditation Board for Engineering and Technology (ABET) Criterion 3 of the 2006 – 2007 Criteria for Accrediting Engineering Technology Programs states: “Each program must utilize multiple assessment measures in a process that provides documented results to demonstrate that the program objectives and outcomes are being met”. [4]

The Section 6.16 of the NAIT accrediting standards likewise includes language that requires an assessment plan.

6.16 Assessment: *An assessment plan shall be comprised of, but not limited to, the following for each program: (1) program mission statement, (2) the desired program outcomes/student competencies, (3) evidence that the program incorporates these outcomes/student competencies, (4) the assessment measures used to evaluate student mastery of the student competencies stated, (5) compilation of the results of the assessment measures, and (6) evidence that these results are used to improve the program. [5]*

The Higher Learning Commission, a commission of the North Central Association, also addresses the need for assessment systems appropriate to document student learning [6]. There are common threads which weave through these different accreditation models. One is an emphasis on student success; something the authors believe should be first and foremost in the minds of all educators. Another common element is the lack of a prescribed assessment plan, but rather a guiding set of overall principles that include multiple measures or approaches to data collection that can include quantitative and qualitative data. A third, but by no means final, feature is the use of this data to refine and improve the educational programs.

This third aspect is quite similar to concepts contained within ISO 9000, Baldrige-style organizational assessments, and any other well designed strategic planning model. Most planners agree an organization that does not undergo periodic examinations will not grow, and most likely will decline. If growth does occur, it will not be sustained and will not necessarily assist the organization in meeting its goals.

The authors have heard the complaints of other educators wondering “why assessment?” and comments that it has been imposed by “them.” Given the broad latitude of the previously noted accrediting bodies it is not as difficult to formulate an assessment plan as one may initially believe. The Industrial Distribution program at the University of Nebraska at Kearney is one of the largest accredited programs of its type. When the decision was made to seek accreditation it became clear a formal assessment plan needed to be developed. However, when the program was initially accredited in 2002 one of the criteria cited as weak was the assessment plan. Through a series of faculty meetings and working with the campus Coordinator of Assessment it became evident it was not necessary to “reinvent the wheel” but to utilize aspects of the program that were, for the most part, already in place.

STUDENT OUTCOME STATEMENTS

Amos [7] discusses the application of assessment techniques to measure industry desired competencies. Industry desired competencies are what our ITEC Department values most as it is what our industry partners value most. It is for those very competencies that our industry partners seek out the graduates - the product, from a process view point.

Each program within the ITEC Department of Industrial Technology has a comprehensive set of student outcome statements (competencies) that are measured to assure the programs meet the ITEC Departmental mission and objectives. For Industrial Distribution these competencies were initially identified in the Delphi study *Essential Competencies and Traits for Industrial Distribution Careers* [8]. Competencies for the other programs have been identified via other methodologies, but in all cases appropriate industry input was drawn upon and is employed on an ongoing basis to keep the programs aligned with current industrial practices.

ASSESSMENT METHODS

A review of the literature indicates a seemingly endless variety of methods used to assess student learning outcomes and program success. Among the most common means of assessing students and programs is through the use of certification exams, student surveys, and a capstone experience [9]. Each of these means, in addition to others, has been used at UNK over the years, each with varying degrees of success.

Through the process of evolution over the past decade the ITEC Department now uses five assessment measures (two direct, three indirect) directly tied to student outcome statements. Quantitative and qualitative data collected from the direct and indirect assessment instruments is annually evaluated by ITEC Department faculty, industry representatives and program advisory committees to determine changes that may be required in the curriculum.

OVERVIEW OF ASSESSMENT INSTRUMENTS AND PROCESS

The Industrial Technology ITEC Department assesses its program effectiveness in keeping with the National Association of Industrial Technology (NAIT) accreditation standards. Direct measures include the *Final Evaluation of Intern by Work Site Supervisor*, and the *Comprehensive Exam* for each program. Indirect measures include the *Employer Survey*, the *Graduate Survey* and the *Student Confidence Scale*. The Student Confidence Scale correlates directly with the Student Outcome Matrix (competencies) for each program. The actual assessment instruments, with the exception of the confidential Comprehensive Exam, can be viewed on-line at <http://www.unk.edu/academicaffairs/assessment/index.php?id=5041>.

The data collected from each assessment instrument is summarized by degree program and evaluated by the ITEC faculty and staff, work site industry representatives and the ITEC program advisory committees as appropriate. Feedback from the assessment instruments are used to determine what – if any – changes may be required in the curriculum. See Tables 1A and 1B for selected examples of the 70 competencies contained in the ID Student Outcome Matrix.

Table 1B: Student Outcome Matrix

	Introduction to Technology	Engineering Design Graphics	Technology Today	Electricity/Electronics	Machine Tool Products &	Industrial Products &	Industrial Products &	Training & Instructional	Applied electronics	Automated Devices & Systems	Manufacturing/Distribution	Industrial Distribution Branch	Occupational Safety & Health	Industrial Management	Leadership in Business &	Industrial Distribution Seminar	Beginning Accounting I	Business Communication	Principles of Marketing	Principles of Selling	Internship	Economics General Studies	Telecommunications Literacy
Competency	ITEC 110	ITEC 120	ITEC 130	ITEC 220	ITEC 251	ITEC 271	ITEC 272	ITEC 290	ITEC 320	ITEC 351	ITEC 451	ITEC 452	SFED 435	ITEC 308	ITEC 408	ITEC 490	BACC 250	BSED 320	BMKT 300	BMKT 331	ITEC 475	ECON GS	ITEC 150
III. BUSINESS																							
Understand the principles of selling.						X	X				X									X			
Comprehend industrial marketing.						X	X												X				
Understand total quality management							X										X						
Understand human motivation and behavior.											X	X		X					X	X			
Comprehend the principles of economics																						X	
IV. ORAL AND WRITTEN COMMUNICATION																							
Speak in a professional and convincing manner.								X	X					X	X								
Write concise and professional business letters and reports.																		X					
Use appropriate vocabulary.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Speak the language of industry.					X	X	X			X	X				X			X	X				
Convey organized thought patterns.						X	X	X		X	X						X			X	X		

Final Evaluation of Intern by Work Site Supervisor (Direct Measure): All CM, ID, TM students are required to participate in an internship and this evaluation is a required component of the internship. The intern's supervisor completes the evaluation at the end of a 12 credit-hour (480 work hours) internship usually completed between the student's junior and senior years which must be signed by both the student and the employer.

The purpose of this measure is to document progress from the midterm evaluation and evaluate the training plan objectives set at the beginning of the internship as well as work performance. While each internship training plan is unique to the student and the employer there is a standard group of questions in the Final Evaluation of the Intern by Work Site Supervisor instrument covering the areas of Productivity, Business Techniques, and Personal (see Table 2). The questions tend to address the "soft" skills needed to be successful in the profession. They tend to be the most difficult to teach and are the ones which highly influence the success or failure of the individual. Given their importance, assessing the skill sets is essential.

**TABLE 2
WORK PERFORMANCE EVALUATION**

<p>Productivity</p> <p>Volume of work Quality of work Steadiness Knowledge of work Interest in work Attention to detail Organizing efficiently</p>	<p>Personal</p> <p>Appearance/Dress Initiative Tact Accuracy Judgment Patience Creativity Self-Confidence Cooperation Flexibility Dependability Leadership Motivation Tolerance for stress Independence Willingness to work</p>
<p>Business Techniques</p> <p>Meeting People Working harmoniously with others Telephone techniques Following instructions Accepting criticism Oral communication Written communication Listening Relationship to Supervisor Relationship with Co-workers</p>	<p>Comments</p> <p>Allows for employer and/or student comments</p>

Many of the soft skills are addressed in student run organizations such as the Industrial Distribution Organization (IDO) meetings, effectively making IDO an integral part of the curriculum. The information gathered through this instrument is summarized by degree program and distributed to faculty for review with input from industry representatives and advisory committee personnel.

COMPREHENSIVE EXAM (DIRECT MEASURE)

A comprehensive exam for each program was developed and administered for the first time during the spring semester 2005. The exam was given to all graduating seniors to determine the knowledge level mastered, both technical and non-technical, during the students UNK experience. Before the development of the comprehensive exam, one approach the department pursued was the use of a nationally normed exam. The department is comprised of four quite distinct programs, and while there is a core group of Industrial Technology classes required in all the majors, a one size fits all exam addressing each program was determined to be impossible to either purchase or to produce. Even instruments such as the Society of Manufacturing Engineer’s technologist exam or NAIT’s Certified Industrial Technologist exam would not adequately cover the material of these different programs. Eventually it was decided to develop a bank of questions from the core classes to be administered to all the seniors. Each program would then also produce a bank of program specific questions for the exam. As the exam has only been administered once thus far, a detailed analysis of the results is not complete and it is not possible to analyze the data in a longitudinal manner.

EMPLOYER SURVEY (INDIRECT MEASURE)

For every student returning the Graduate Survey (see below) an Employer Survey is sent to the graduate’s current employer. The Employer Survey is administered with Opinio, a Web based survey software package, at the one and five year anniversaries of the student’s graduation, in part to satisfy NAIT accreditation requirements. Employers are asked to provide information about the graduate in terms of their initial hire position, current position, the degree to which they have increased responsibility, work performance, productivity, business techniques, personal characteristics, and the employers overall satisfaction with the graduate. The questions are purposely almost identical to those in the Final Evaluation of Intern. One reason for this is to be able to compare the student’s performance as an intern versus their performance as an employee. A second reason is that the desired information is essentially the same. Ratings as to how well satisfied our industry partners (employers) are with our graduates after hire is of the utmost important to us. Employer overall satisfaction data (Table 3) from 2005 is as follows:

TABLE 3

INDUSTRY’S REACTION TO INDUSTRIAL DISTRIBUTION GRADUATES (2005)

How would you rate your overall satisfaction with this employee?						
	Not Satisfied 1	2	3	4	Very Satisfied 5	Total
Count	0	0	0	2	7	9
Percent	0	0	0	22.22	77.78	100
Average: 4.78		Minimum Value: 4			Variance: 0.19	
Median: 5.0		Maximum Value: 5			Std Deviation: 0.44	

GRADUATE SURVEY (INDIRECT MEASURE)

Just like the Employer Survey, the Graduate Survey is sent to all graduates one and five years after graduation also using Opinio. In addition to its ease of use, one of the primary reasons for using the Opinio software for the Graduate and Employer surveys (see Table 4) is its ability to compile the data as it is collected and to import the data into a spread sheet making data analysis much easier. This survey is used to help gauge the success and advancement of graduates in the

workplace and to evaluate the strengths and weaknesses of the program from the graduate’s perspective. Information is sought about how satisfied the graduates are with the quality of instruction received, quality of facilities, equipment and academic services. Employment status, salary and advancement information is also sought.

STUDENT CONFIDENCE SCALE (INDIRECT MEASURE)

The Student Confidence Survey (see Table 4) is administered to all graduating seniors just prior to graduation and helps the curriculum planners within the ITEC Department gain an understanding as to how confident the students feel that they are prepared in terms of knowledge, skills and abilities to successfully enter the workplace upon graduation. The Student Confidence Scale correlates directly with the Student Outcome Matrix for each program.

TABLE 4

ASSESSMENT METHODS

Method	Advantages	Disadvantages
Final Evaluation of Intern by Work Site Supervisor	Direct measure. Measures soft skills. Measures long term personal development. Easy to administer.	Can be subjective – depends on supervisor’s definition of survey terms. Lack of uniformity from supervisor to supervisor.
Comprehensive Exam – internally developed	Direct measure. Easy to administer. Subjectivity or bias is less likely. Over time validity and reliability can be established.	May not measure employer’s requirements. Time lag between course work and administration of exam may skew results.
Employer Survey	Indirect measure. Correlates with Intern Evaluation. Large data base over time.	Lack of uniformity from employer to employer. Does not measure cognitive capabilities.
Graduate Survey	Indirect measure. Measures attitudes toward university, college, department, and major	Difficult to maintain contact over time.
Student Confidence Scale	Captive population makes it easy to administer.	Without work experience judgments may be unreliable.

ASSESSMENT PROCESS

Each year, either at the end of the spring semester or during the summer session, the ITEC Department administers both its direct and indirect assessment instruments. The Comprehensive Exam and Student Confidence Scale are administered at the end of the academic year each spring. The Graduate Survey and Employer Survey are administered one year and five years after graduation. The Final Evaluation of Intern by Work Site Supervisor is administered during the student’s internship experience usually between their junior and senior year. The assessment instruments use a combination of paper and pencil instruments, computer assisted surveys through the Blackboard learning management system and through the use of Email and Opinio.

The evaluation of the assessment process is the most important part of the process. It would be meaningless to implement an assessment process, collect detailed data, and do nothing with the data, other than place it on a shelf. To assure a continuous cycle of curriculum improvement faculty, staff, industry partners and advisory committees meet annually to review the assessment the data. It is important again to stress that the ITEC advisory committees, made up from industry partners, play an integral role in reviewing assessment data and making recommendations to faculty for curriculum improvement. It is

believed that the UNK ITEC programs would not be as successful as they are today without this industry involvement. A list of Industrial Distribution business partners, updated annually, can be viewed on-line at www.unkid.org.

RESULTS AND IMPLEMENTING RESULTS

The ITEC Department conducted its last assessment during 2005 for all of its programs. Following is the outcome of the review and analysis for the ID program.

GRADUATE SURVEY - ANALYSIS

Fifty-six people were invited to respond to the Graduate Survey. A total of 36 responses were received for a return rate of 64%. Eighty percent of the ID alumni indicated their primary objective for attending UNK was to prepare for immediate entry into a career. In 2005, over 97% claimed this objective was fully or somewhat achieved. Over 94% rated overall satisfaction with the quality of their learning experience as good to excellent. Quality is evident in the program when over 91% of the alumni would recommend UNK to others.

Within the *UNK Student Services* offered, students were most satisfied with Career Planning and Job Resources. Again, this speaks highly for the Industrial Distribution Program which holds two careers fairs each year for ID majors. They were least satisfied with UNK Financial Aid Services. The ID program is successfully finding new sources of funds for scholarships to help increase the satisfaction level.

From the *Academic Service Categories*, students were most satisfied with (1) Faculty Concern for Students, (2) Courses in the Major, and (3) Faculty Availability. Again, these findings speak highly for the faculty. The students were least satisfied with the General Studies Courses.

The majority of the respondents were satisfied with the facilities and equipment in the ITEC Department. Eighty percent started immediately into their job following graduation. With one exception at the time of the survey, all of the respondents were fully employed. That individual indicated he was not seeking a job. The value to companies offering an internship is clearly apparent. Nearly 46% are currently working for the company where they completed their internships. Ninety-seven percent of the respondents to the survey are living in five states, with 47% choosing jobs in Nebraska, followed by Kansas (12%), Missouri (6%), California (6%), and Colorado (6%).

Employer Survey - Analysis

Fifteen people were invited to respond to the Employer Survey. A total of nine responses were received for a return rate of 60%. The employers replied that most UNK graduates were doing an outstanding job in terms of Volume and Quality of Work; they worked best at Meeting People and Working Harmoniously with Others. They ranked average to good at Accepting Criticism. Of the Work Performance Characteristics listed, UNK alumni were ranked highest by employers in Initiative, Self-confidence, Dependability, and Willingness to Work. While still receiving a good rating, their ability to deal with Stress, Patience, and Tact, were rated the lowest. On a 1 to 5 Likert scale with 5 being very satisfied with the employee, the graduates received an overall average score of 4.78.

STUDENT CONFIDENCE SCALE - ANALYSIS

Seventeen students were invited to respond to the Student Confidence Scale Survey. A total of 16 responses were received for a return rate of 94%. The respondents were asked to evaluate their abilities to perform 70 different tasks. A 7 point Likert scale was used with 1 representing insufficient ability and 7 representing excellent ability. The lowest ability score was 4.59; the highest 6.29. Overall, the faculty is very pleased with the outcome of these findings and are addressing the causes of the lower scores. For example, the respondents rated their ability to “describe finance and accounting as related to other organizational activities” as 4.65. Although this score is acceptable, and after discussions with advisory committee members, a new unit in Distributor Economics has been added to the ITEC 452 course syllabus.

FINAL EVALUATION OF INTERN BY WORK SITE SUPERVISOR - ANALYSIS

Fifty six people were invited to respond to the Final Evaluation of Intern by Work Site Supervisor Survey. A total of 53 responses were received for a return rate of 95%. The Final Evaluations of Interns by Work Site Supervisors is a summary of individual comments and evaluation of work performance in terms of productivity, business techniques, and personal behaviors. In the Productivity Category, interns were rated highest in Interest in Work and Volume of Work Performed. While still rated good to outstanding, interns ranked lowest in Organizing Efficiently. In the Business Techniques Category, interns ranked highest in their Ability to Work Harmoniously with Others and in Meeting People. While most scores were good to outstanding, they rated lowest in Telephone Techniques and Accepting Criticism. In the category of Personal Behaviors, the interns ranked highest in Dependability, Flexibility, Cooperation, and Willingness to Work. While most scores were good to outstanding, they rated lowest in Leadership and Judgment. The good news is that only one respondent said they would not be interested in having another intern from the ID program. The majority of respondents are very much interested in hiring more interns from UNK.

CONCLUSION – ASSESSMENT OF THE ASSESSMENT PROCESS

During the spring semester of 2005 the faculty of the ITEC Department of Industrial Technology considered the following points:

1. Are the desired outcomes for graduates of the ITEC Department relevant and defensible?
2. Do the current means of assessing actually assess the ITEC Department's desired outcomes for graduates and provide information that allows for continuous improvement of ITEC Departmental programs?
3. Is the scope and focus of our assessment process reasonable?
4. Should any assessment activities be discontinued or added?

Upon reviewing student outcomes and the measures used to assess the outcomes, the faculty of the ITEC Department believes the outcomes for graduates of the ITEC Department are relevant and defensible. It is important to note that during each step of the assessment process, the program advisory committees are an integral part of the review process. Given that the process allows for assessment to occur at both the course level, at the end of the internship, and after graduation the faculty believe that the data collected will allow for program improvement.

While the process is time consuming, it is increasingly more reliable. The ITEC Department has been collecting data for many years and the survey instruments have changed in scope and size as the assessment process has evolved. The faculty constantly evaluates its existing curriculum, internship program, and assessment activities and believes that the assessment practices are strong and provide excellent feedback to the program. The assessment activities have had a positive and measurable impact in improving the ITEC programs.

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