VOLUME 31, NUMBER 1
April
through
June 2014

JTMAE
The Journal of Technology, Management, and Applied Engineering

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Keywords:
Assessment, Higher Education, Lean Manufacturing, Manufacturing, Professional Development, Teaching methods, Teamwork

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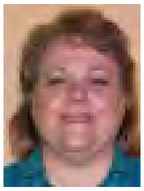

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Holistic Student Professional Development and Assessment: A Backward Design Approach

Dr. Jacqulyn A. Baughman, Dr. Thomas J. Brumm, and Dr. Steven K. Mickelson

ABSTRACT

The study of competencies opens the door to insights about humans and human talent and potential applications for their development (Boyatzis, 2009). Successful transition from academia to the twenty-first century workplace requires that college graduates acquire technical skills in their field as well as skills for interacting effectively with people (Hayward & Blackmer, 2007). This case study examines holistic student professional development through competency based assessment. A lean manufacturing course in Iowa State University's Industrial Technology degree program served as a foundation for utilizing the "backward design" process (Wiggins & McTighe, 1998). Results indicate that holistic professional development was achieved as measured using: (a) competency assessments, and (b) captured student perceptions through structured self-reflection. Additionally, this study provides a framework for a holistic approach to student professional development and assessment.

INTRODUCTION

Because most college-aged students are entering adulthood, the attitudes, interests, values, and character development that underlie their behaviors may not be at the professional level (Hayward, Noonan, & Shain, 1999). A problem higher education faculty face is lack of a framework for holistic student professional development and assessment. Such a framework can serve as a bridge between academic and professional identity development. The goal of this study is to utilize the "backward design" process to integrate experiential, professional development activities into the classroom. Professional identity development is gained through the process of professional socialization in which an individual learns to adopt the values, skills, attitudes, norms, and knowledge needed for membership in a given society, group, or organization (Merton, 1957). Boyzatis (2009) found that emotional, social, and cognitive intelligence competencies predict effectiveness in professional, management, and leadership roles in many sectors of society. These competencies can be developed in adults. Competency models can be used to guide individual professional development and in developing curricula that meet the needs of employers (Rothwell & Wellins, 2004). A number of empirical studies of on-the-job excellence have clearly and repeatedly established that emotional competencies—communication, interpersonal skills, self-control, motivation, etc.—are much more important for superior job performance than are cognitive and technical abilities (King & Skakoon, 2010). In his book, Working with Emotional Intelligence, Goleman (2005) cited numerous studies that indicate emotional competencies are twice as important in contributing to excellence as are pure intellect and expertise.

Since the concept of competency-based human resource management was first proposed in the 1970s as a critical differentiator of performance, it has become a common practice (Boyatzis, 2009). Built upon earlier work on skills, abilities, and cognitive intelligence (Campbell, Dunnette, Lawler, & Weick, 1970), it became a tool for understanding the talent and capability of human capital within an organization. In the 1980s, a competency-based assessment tool, the 360-degree feedback process, was introduced and has become a predominant workplace reality (McCarthy & Garavan, 2001). The fundamental premise is that data gathered from multiple perspectives are more comprehensive and objective than data gathered from only one source (Dyer, 2001).

Many organizations use some form of the 360-feedback assessment process (Nowack, 1993), and it is implemented in a variety of ways. Ratings from self and others, however, constitute the core of the 360-degree feedback process (Tornow & London, 1998). The four common feedback sources utilized in a 360-feedback process include: self, peers, managers, and subordinates (McCarthy& Garavan, 2001). The 360-degree process used today stems from two traditions in industrial and organizational psychology (Tornow & London, 1998). One is the employee attitude survey (Nadler, 1977), and another is the performance appraisal. The dynamic nature of an ever-changing work environment has added to the popularity of this assessment tool—job complexity requiring multiple perspectives on employee performance, organizational restructuring placing the developmental burden on the employee, and the lack of structured career paths (Tornow & London, 1998).

The benefit of collecting this type of data is that the person gets to see a panorama of perceptions rather than just self-perception, thus affording a more complete picture. Self-assessment ratings require self-reflection and introspection, as the individual process of looking inward, reflecting and evaluating where one stands in relation to feedback (Tornow & London, 1998). Peer assessment helps students to diversify their own approaches and strategies in undertaking a learning task and can deepen understanding about high- or low-quality performance (Gibbs, 1999). This socially and intellectually challenging activity can enable students to develop capacities appropriate to professional and other contexts (Vu & Dall'Alba, 2007). The popularity of this practice has stimulated much research enthusiasm in the academic field (Dai, De Meuse, & Peterson, 2010).

PROFESSIONAL DEVELOPMENT

Professional development (PD) can be defined in diverse ways and can take many forms. Typical levels of professional development likely to be encountered are: individual, group or program, departmental, divisional, and professional associations. In the 1970s, the United Nations Educational, Scientific, and Cultural Organization (UNESCO) created definitions in which three educationally-focused terms were used to descriptively summarize the types of PD: formal, nonformal, and informal education (Schwartz & Bryan, 1998). Formal education is classroom education, with nonformal considered as "any organized, systematic, educational activity, carried on outside the framework of the formal system, to provide selected types of learning to a particular subgroup in the population" (Coombs, 1985, p. 23). Informal education is learning by association and affiliation, specifically, "the life-long process by which every person acquires and accumulates knowledge, skills, attitudes, and insights from daily experiences and exposure to the environment" (Bhola, 1983, p. 47).

In Homer's The Odyssey, Odysseus entrusted his son's education to the one person he trusted with his own life, his friend, Mentor. Today, a mentor remains someone referred to as a person who is trusted, forming a relationship with the mentee of guidance and advice, and one of many activities clustered under the broader term of professional development (Schwartz & Bryan, 1998). Over the last 20 years the central finding of a plethora of mentoring research has been the association between the presence of a mentor and career success (Allen & Eby, 2007; Kram & Ragins, 2007). A study using a career capital (human, agentic, and developmental network) framework, found that mentoring added value, above and beyond the other forms of career capital, in predicting promotions and advancement expectations (Singh, Ragins, & Tharenou, 2009). Additionally the study concluded "although mentoring mattered for career success, it represented just a portion of a constellation of career resources that are embedded within individuals and their relationships" (p. 56).

One benefit for all professionals is the transformative value of professional development (Schwartz & Bryan, 1998). Whether it is achieved individually, in groups, in formal classes, or in a workshop, the process of renewal and growth essential for human development is more likely to be found in professional development activities than in any other type of activity Schwartz & Bryan, 1999). As we move into a new century, organizations are finding great value in the ability to change or transform quickly in response to new technologies, new opportunities, and new demands. These changes can come from outside the organization or from within. As professionals, we assume an ethical charge and duty to maintain a level of knowledge and currency in a chosen field (Bayles, 1981).

CONCEPTUAL FRAMEWORK

This study examines holistic student professional development and assessment through the lens of the backward design process advocated by Wiggins and McTighe (1998). The backward design process served as the conceptual framework for this study. A process description was condensed by Field, Freeman, and Dyrenfurth (2004) into three broad steps: (a) identify desired results, (b) determine acceptable evidence, and (c) plan learning experiences and instruction. Wiggins and McTighe stated that:

> it encourages us to think about a unit or course in terms of the collected assessment evident needed to document and validate that the desired learning has been achieved, so that the course is not just content to be covered by or a series of learning activities (p. 12).

This framework requires us to think about what student outcomes should be in a course, to design the course to reflect this, and to ensure that an appropriate assessment is in place to provide evidence of outcomes achievement. It is also a foundation for course and curricular continuous improvement.

The backward design process was utilized by Field et al. (2004) to advance their goal of holistic assessment of undergraduate students in an industrial technology program. They explored non-classroom-centered assessment methods and collected and analyzed preliminary data towards their goal attainment. Their work was valuable to this current study through lessons learned, purpose, and the backward design starting point recommendations as follows:

> One must have a fairly specific vision of the knowledge, skills, and attitudes a technology student should develop prior to embarking on his/her career before formulating an assessment plan. In other words, what is to be assessed?
>
> A clear understanding of the reasons for assessing technology students is critical. These reasons may originate in basic requirements to uncover information regarding students' knowledge, skills, or attitudes. One may wish to verify that students can demonstrate practical technology skills and related professional skills, or one may desire to motivate and enhance learning. Ultimately, it is the goal of the faculty to have more than just course grades to reflect student performance.
>
> A well-structured program should include assessment by a variety of methods and from a more holistic perspective than is often currently employed. An ancillary benefit of a more holistic assessment may be a more positive student attitude about the discipline (p. 78).

The approach used by Field et al. (2004) guided this study's holistic student development approach and philosophically connected with their ultimate hope, "to accelerate students' learning more effectively and efficiently, and jumpstart them into their profession" (p. 79). Holistic professional development must include a holistic assessment process to determine results. Letter grades were not included in this study.

STUDENT DEVELOPMENT

Student development research literature has been synthesized (Knefelkamp, Widick, & Parker, 1978) into five clusters: psychosocial theories, cognitive developmental theories, maturity models, typology models, and person-environmental interaction models. Noting that they "did not find, nor could we create, the comprehensive model of student development" (p. xi), however, these have remained as separate lines of theorizing through much of the student development literature. Constructing a holistic theoretical perspective requires focusing on intersections rather than separate constructs. Kegan (1982), a pioneer in a holistic theoretical perspective, advocated focusing on the context rather than the polarities. Despite ongoing efforts, Abes, Jones, and McEwen (2007) noted, "Few models or theories exist to understand the holistic development of college students" (p. 16). Despite leaving us with pieces in the holistic development puzzle box, student development theory renders us unable to assemble a complete picture that represents holistic student development. It serves rather as a guide and reference point.

METHODOLOGY

Departmental Background

Iowa State University's approach to increasing outcomes and assessment-based accreditation requirements was the development of workplace competencies (Brumm et al., 2006). Collaboration with Development Dimensions International, Inc. (DDI, 2004)—a global provider of competency-based performance management tools and services—provided the department with 14 workplace competencies (http://learn.ae.iastate.edu/ Competencydefinitions.pdf). These competencies were mapped to degree program outcomes. Each competency was defined clearly, concisely, and independently. Specific to each definition, a set of observable and measurable key actions was developed. The department's outcomes plan also included the development and incorporation of a competency-based assessment format, based on a Likert-style rating system.

Study Design

In order to explore holistic student professional development, a mixed methods approach was used, which is a procedure for collecting, analyzing and mixing or integrating both quantitative and qualitative data at some stage of the research process within a single study (Creswell, 2005). The researchers utilized this approach because neither quantitative nor qualitative methods alone provide a complete picture of holistic student development. Thus the complementary nature of a mixed methods approach was sought in the design of this study.

Participants and Data Collection

The participants in this study were twenty-six senior-level undergraduate students enrolled in a lean/cellular manufacturing course. The course is required within the degree program's manufacturing option. The students completed initial and final competency assessments completed at the beginning and end of the semester respectfully, as the first piece of this study. These assessments comprised the quantitative data collection method, as well as, exposed students to the 360-degree feedback process. They served as an indicator of student competency growth during the 16-week semester. The second piece of the study consisted of a structured self-reflection paper to capture qualitative data. This served to capture student's perceptions of professional development, and was completed at end of the semester (16th week). Completion of the competency assessments (quantitative) and structured self-reflection paper (qualitative) were assignments incorporated into the semester's syllabus, as outlined in Baughman (2012a and 2012b).

Step 1: Identify Desired Results

A senior level, undergraduate industrial technology course in lean/cellular manufacturing provided the opportunity to apply the backward design. Degree program outcomes linked to workplace competencies and frequency of the department's "core" competencies in the course were used to determine the course's "top five" competencies: (a) analysis and judgment, (b) communication, (c) initiative, (d) continuous learning, and (e) teamwork. A sixth competency, engineering/technical knowledge, was also identified and connected to course content as "lean knowledge." The definitions for the course competencies can be seen in Table 1. These competencies represent desired result 1 (DR1): holistic student lean professional development and assessment.

The competencies' key action items, seen in Table 2, served as the foundation for assessments throughout the semester. A 360-degree feedback/assessment process was integrated into the course and represented desired result 2 (DR2): experience with 360-degree feedback/assessment process. A need to understand student experiences and identify course continuous improvement areas led to desired result 3(DR3): understand students' professional development during the semester.

TABLE 1. DEFINITIONS OF COURSE COMPETENCIES

Compentency	Definitions
Analysis and Judgment	Identifying and understanding issues, problems and opportunities; developing the relevant criteria and comparing data from different sources to draw conclusions: using effective approaches for choosing courses of action or developing appropriate solutions; taking actions that are consistent with available facts, constraints, and probably consequences.
Communication	Clearly conveying information and ideas through a variety of media to individuals or groups in a manner that engages the audience and helps them understand and retain the message.
Initiative	Taking prompt action to accomplish objectives; taking action to achieve goals beyond what is required; being proactive.
Continuous Learning	Actively identifying new areas for learning; regularly creating and taking advantage of learning opportunities: using newly gained knowledge and skill on the job, and learning through applications.
Teamwork	Effectively participating as a member of a team to move the team toward completion of goals.
Engineering/Technical Knowledge	Having achieved a satisfactory level of knowledge in the relevant specialty areas of engineering/ technology, science, and mathematics.

TABLE 2. COURSE COMPETENCIES AND KEY ACTIONS ASSESSED

Compentency	Key Actions	
Analysis and Judgment	KA1	Identifies issues, problems and opportunities
	KA2	Gathers information
	KA3	Interprets information
	KA4	Generates alternatives
	KA5	Chooses appropriate action
	KA6	Commits to action
	KA7	Involves others
	KA8	Values diversity
Communication	KA1	Organizes the communication
	KA2	Maintains audience attention
	KA3	Adjusts to audience
	KA4	Ensures understanding
	KA5	Adheres to accepted conventions
	KA6	Comprehends communication from others
Initiative	KA1	Goes above and beyond
	KA2	Responds quickly
	KA3	Takes independent action
Continuous Learning	KA1	Targets learning needs
	KA2	Seeks learning activities
	KA3	Maximizes learning
	KA4	Applies knowledge or skill
	KA5	Takes risks in learning
Teamwork	KA1	Facilitates goal accomplishment
	KA2	Informs others on team
	KA3	Involves others
	KA4	Models commitment
Engineering/Technical Knowledge	KA1	Knowledge of mathematics
	KA2	Knowledge of science
	KA3	Knowledge of experimental analysis
	KA4	Knowledge of current engineering/ technology tools
	KA5	Knowledge of technology

Note. *Key action item used in assessment for engineering/technical knowledge competency.*

Step 2: Determine Acceptable Evidence

Each of the desired results was addressed, and the evidence was incorporated into the course design, as outlined in Figure 1. Previous work by Baughman (2012b) provided course competency-based assessment quantitative results and captured student perceptions of the 360 degree assessment process.

FIGURE 1. DESIRED RESULTS (DR) AND CORRESPONDING EVIDENCE

DR1: holistic student lean professional development and assessment
course competency-based assessment
capture student developoment perceptions

DR2: experience with 360-degree feedback assessment/process
participation in 360-degree process
capture 360-degree student experiences

DR3: understand students' professional growth
capture student perceptions

Step 3: Plan Learning Experiences and Instruction

On the first day of class, students are introduced to course competencies and all competency-based assessment, as it is introduced during their first year of enrollment in the department. The top five course competencies identified were assessed during the semester utilizing the 360-degree feedback/assessment process and results reported (Baughman, 2012b). Additionally, a 20-question initial and final lean knowledge assessment was completed. The pre- and post-course survey results were obtained and reported (Baughman, 2012a). Lean project teams are assembled during the first week of class. Team composition is determined based on the pre-course survey, initial lean knowledge assessment, and industry selection results. Each student team was provided an industry mentor to provide guidance on their lean project. Over the next five weeks students were in-class and experience various instruction tools aimed at competency development. This included, but was not limited to: team assembly setup and cellular design, SMED, 5S, Kaizen, value stream mapping, JIT, standard work, and guest speakers (former students who are practicing lean professionals and other lean professionals). Over the course of the semester, team and individual assignments were completed, as outlined in the syllabus, and focused on competency development. The specific details of each are not presented in this study.

The teams spent the next five weeks predominantly working with industry mentors onsite. At mid-term students completed an "initial" peer/team member assessment, and the instructor provided confidential peer competency assessment results (Baughman, 2012b). Additionally, teams presented their lean project progress status, and instructor assessment and feedback, as well as peer feedback, were provided. During the 14th week, the final self and peer top five competency and lean knowledge competency assessments were completed. The instructor provided confidential peer assessment results (Baughman, 2012b). During the 15th and 16th week the industry mentors attended the final student lean project team presentations. The semester ended with a structured self-reflection paper assignment (Figure 2).

DATA ANALYSIS AND RESULTS

Competency Assessments and Surveys

The top five competencies' key action items were assessed and analyzed through paired t-testing to detect significant average differences and results reported (Baughman 2012b). Pre survey results were obtained and descriptive statistics reported (Baughman, 2012a). Post survey results were obtained and the qualitative results reported (Baughman, 2012a). The lean knowledge competency was assessed and analyzed with SPSS 19 software utilizing paired t-testing. Results, provided in Table 3, indicated competency development was obtained, measured by the average increase in the final over the initial average score (*).

Student Self-Reflection

Twenty-three senior-level undergraduate students in the lean manufacturing course completed the assigned final structured self-reflection. The analysis focused on questions 1, 2, 3, 4, 7, and 8 (Figure 2). Content analysis was used for analyzing and interpreting the student responses (Ratcliff, 2002). The responses were entered into a spreadsheet; numbers rather than student names were entered in rows. The focus of the analysis was to bring meaning to student self reflection responses. The process of data analysis consisted of several steps to identify emerging themes. and began with open coding, as described by Esterberg (2002), "in this initial stage, called open coding, you work intensively with your data, line by line, identifying themes and categories that seem of interest"(p. 158). There were 5 rounds of open coding to identify patterns and commonalities upon which to focus based on student responses outline in the structured self-assessment. In doing so, the emergence of themes from the data determined.

TABLE 3. PAIRED SIGNIFICANCE T-TEST FOR LEAN ASSESSMENT (N=25)

Assessment	Assess	M	t	df	r	P
Lean Knowledge	Initial Final	6.35 8.34	8.344 ***-6.676***	24	-0.043	0.000*

Note. *p<.05, two-tailed. Assessment total = 10 points (20 questions).

FIGURE 2. FINAL SELF-REFLECTION PAPER FORMAT

Student Final Self-Reflection Paper

Prepare a 3-5 page document/paper (single-spaced, 12-font, 1" margins) that reflects upon experience in this course during the semester. This is a self-reflection about your professional development/growth, and the 360-feedback assessment experience (competency assessments) per the guidelines below.

Address the following in your self-reflection to describe your journey this semester:

1. Reflect on how you've developed as a professional since your initial top 5 workplace competencies self-assessment - compare with your final self-assessment.
2. Develop a STAR for your top 2 competencies and describe your performance in each competency:

   S/T=Situation/Task, A = Action, R = Result

3. Reflect upon your lean knowledge assessments. Compare pre and post-assessment results. Where were areas that you improved the most? What area(s) need more work?
4. Reflect on the results from your self-and team members /peers' assessments (initial and final). Summarize and compare results. Describe how you feel about the accuracy and fairness of both yourself as an assessor and your team members/peers. How do you feel this 360-feedback process), impacted your professional development (growth)?
5. Team Reflection: How well did your team function together? What were some challenges?
6. What was your overall contribution to the success of your team?
7. How prepared do you feel to improve processes using lean tool/techniques with a future employer?
8. Reflect upon what you feel helped your professional development the most in this course.

Question 1

Students were asked to reflect on their professional development since the completion of their initial top five competencies self-assessment. Overall, students believed that they developed professionally though increased lean manufacturing knowledge, professional/competency growth achievement, and coursework/assignments.

Data analysis results are shown in Figure 3.

Typical student responses are as follows:

> "This class seemed to be built around principles that you use as a working professional . . . I have grown professionally throughout the semester."
>
> "I think that initially my competencies were strong, but after the course was completed I definitely felt improvement, and felt more confident in myself as
>
> ". . . helped me strengthen my professional competencies."
>
> "I feel I have grown a lot within the specific competencies this semester."
>
> "I furthered my knowledge in lean manufacturing."

Question 2

Students were asked to develop a behavioral-based interviewing STAR (Situation/Task, Action, and Result) for their top two competencies based on their self-assessments. The frequency of responses is provided in Figure 4. STAR involves providing an example of a past behavior which includes a situation or task, the specific action taken, and the result of the action (Byham & Pickett, 1997). Figure 4 shows that 93% of the top two competencies were communication (25%), analysis & judgment (25%), initiative (23%), and teamwork (20%).

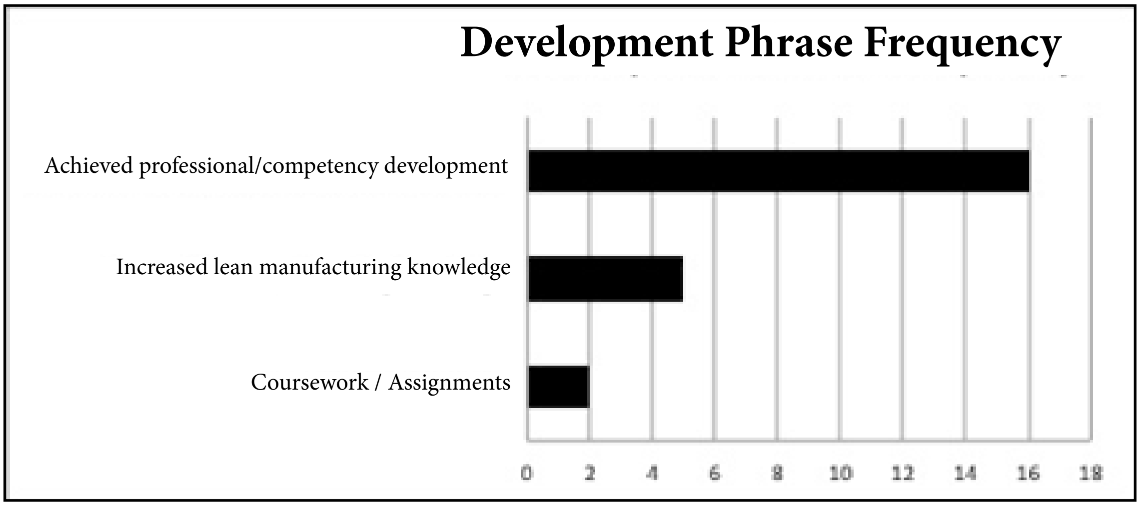
Question 3

Students were asked to reflect the results of their lean knowledge assessments. The results showed that 93% (13/14) of respondents achieved a higher final assessment score. A frequency distribution of the student responses, shown in Figure 5, shows the lean knowledge areas where higher final scores were achieved by the students.

Typical student responses to their lean knowledge assessment results are as follows:

> ". . . improvements in cell design and the seven deadly wastes."
>
> "I couldn't name the 5's like I can now. I also know much more of the words of Japanese-origin. I felt very comfortable taking the

FIGURE 3. PHRASE FREQUENCY OF STUDENT RESPONSES (N=23)



posttest and felt as though I knew more than it showed."

"At the beginning of the semester I received a 70%, at the end I had 100%. So there was definite improvement. The first time I took the assessment I had little knowledge of Lean philosophies and then at the end I had grasped them all."

"Scored higher on my post lean assessment. I also completed the post-assessment in faster time. This tells me that my lean knowledge is better now than it was before."

"My score improved more than 20%. Before taking this class I didn't know what a value stream map was, or how valuable a tool it can be to figure out where a problem could be finish. I felt my knowledge of lean has improved 100%."

Question 4

Students were asked to reflect on their peer assessments, accuracy and fairness, and impact of 360-degree feedback process (Figure 2). The results show that 65% believed the process was fair, accurate and valuable, and 35% believed it was unfair/inaccurate and not valuable. A frequency of student response phrases is shown in Figure 6. Typical student responses are as follows:

"Peer feedback showed that I grew in analysis and judgment, and . . . that was fair."

"The feedback of my peers as well as my initial and final assessments was very similar . . . my weakest competency is communication."

"I felt I was assessed fairly, and assessed my peers fairly . . . realized areas I need to improve."

"I felt that the feedback from my team members' assessment was fair and accurate."

". . . team members were not accurate in the growth and development within the competencies."

Question 7

Students were asked to reflect on their preparedness for future employment (Figure 2). All students, 100%, believed they were prepared from

FIGURE 4: SELF-ASSESSMENT COMPETANCY SELECTION FREQUENCY FOR STAR DEVELOPMENT

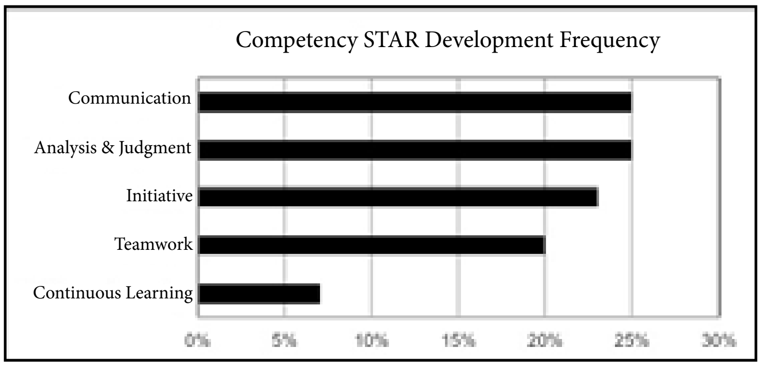
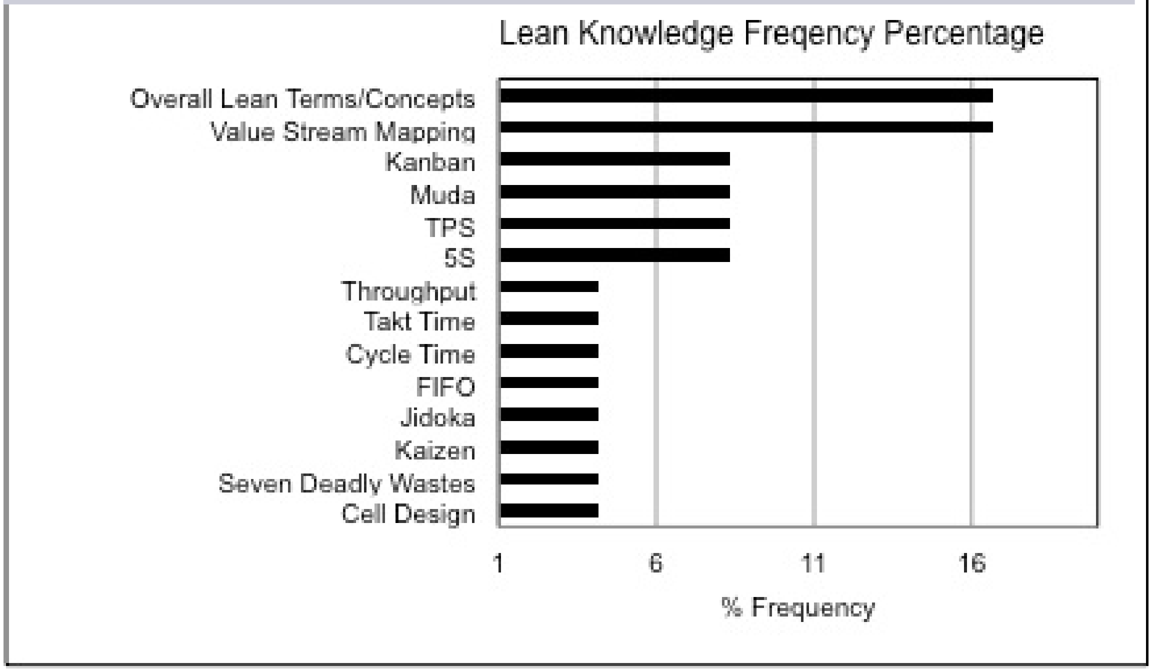


FIGURE 5. LEAN KNOWLEDGE ASSESSMENT REFLECTION PHRASE FREQUENCY



their course experience. Two students believed they were not ready to lead but would be able to become lean team members at their future employment.

Question 8

Students reflected on what helped their professional development (Figure 2). The group project/industry mentor combined phrasing was the most frequently mentioned as contributing to their professional development (65%). A frequency of student response phrases is shown in Figure 7.

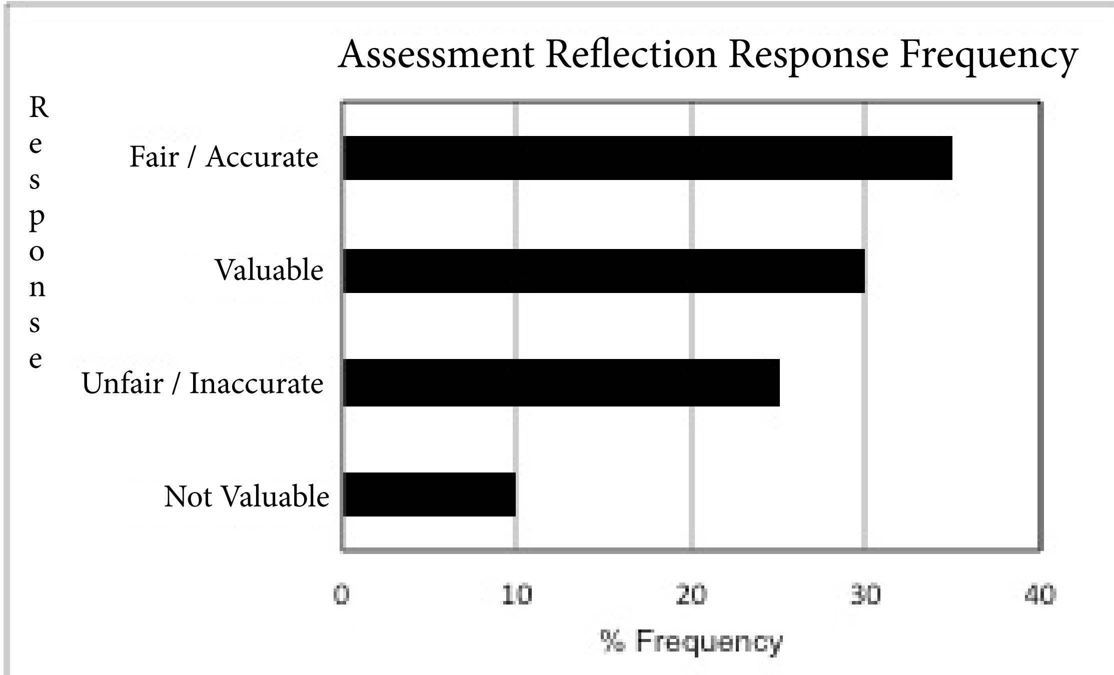
> Typical student responses are as follows:
>
> "Rather than going over book examples and taking tests on the practices of Lean, we actually got our hands dirty on REAL problems and really were trying to make a difference rather than just a simulated one."
>
> "The industry project is helpful to understand the concept of lean as well. It is important to be able to integrate the basic concepts with real world utilization.
>
> "Overall, working on an industry sponsored project was by far the experience that impacted my professional growth."
>
> ". . . working with an industry mentor it gave me a chance to practice professionalism."
>
> "One of the major things that helped me learning is physically going to the place of industry and applying the concepts we covered in class. Being able to have hands-on experience is the best way to learn. We get to see just how everything fits into place and how it actually works when you apply it to something new. This class has opened my eyes to new ideas and concepts I either never heard of or thought about taking into consideration. I've also been able to apply some of the ideas in my current place of employment."

DISCUSSION

This study successfully linked the use of competency-based assessment to the concept of holistic student professional development using the "backward design" process (Wiggins & McTighe, 1998). It included previous work (Baughman, 2012a, 2012b), which provided qualitative and quantitative results of a holistic approach to assessment. The course design consisted of identification of three desired results, determination of acceptable evidence, and planned learning experiences and instruction to achieve holistic student development. The students believed: 1.) they achieved competency development gains; 2.) peer competency assessments were fair, accurate, and valuable and, 3.) lean manufacturing knowledge gains were achieved. Overall results of the student structured self-reflections indicate: 1.) holistic professional development was achieved over the semester, and 2.) industry-mentored projects played a prominent role in student professional development.

The competency-based assessments, and self-reflection were aligned with the work of Boyzatis (2009), (Rothwell & Wellins, 2004), and (Tornow & London, 1998). Utilizing the backward design process provided the course design to reflect professional development utilizing competency-based assessment based on the 360-degree feedback pro-

FIGURE 6. SELF-REFLECTION OF TOP FIVE COMPETENCY PEER ASSESSMENT RESPONSE FREQUENCY



cess, and self-reflection to capture student course experiences. The instructor's goal was to simulate an industry-based professional development process in order to prepare the students for workplace expectations.

LIMITATIONS

All course assignments and activities were not provided in detail here; the major course components, however, were reviewed to highlight the "backward course design" process in order to draw general conclusions and determine future implications. This case study was limited to an undergraduate lean manufacturing course, an Industrial Technology degree program at Iowa State University, assessment of five competencies, as well as, a small sample size. A great deal of research has been directed at the relationship between individual characteristics and rating tendencies; research has focused on characteristics of the raters, the ratee, or both. Team characteristics, diversity, and culture also were not part of this study. In this case study, these characteristics were not the central focus. Additionally, self- and peer-evaluations are not entirely free of biases, which were also not addressed in this study. However, these limitations do not diminish the importance of its purpose nor implications for further research.

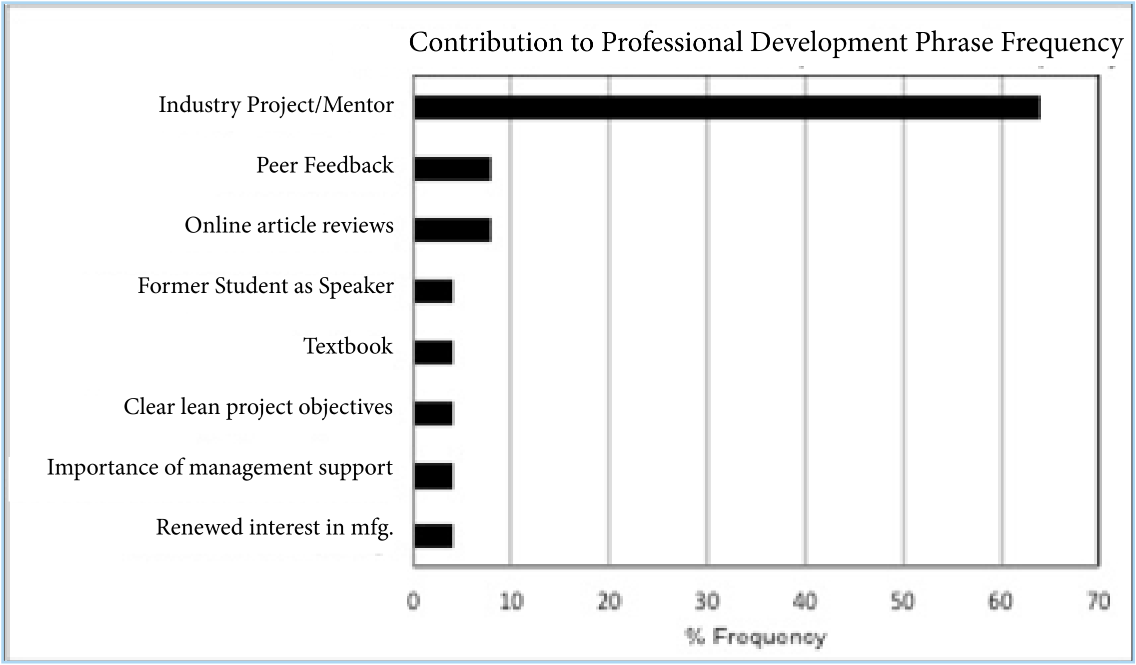
IMPLICATIONS FOR FUTURE RESEARCH

As indicated by the literature, the mentor connection has huge implications for professional development. The student responses also indicated an industry-based project with a mentor was extremely important in their professional development. However, it this was not explored to a large degree in this study. Originally, a mentor assessment was conceptualized; circumstances, however, did not allow for this to become a part of this study. Team characteristics, diversity, and culture also were not part of this study. The implications for future research are for more in-depth examination of the mentor relationship, team characteristics, and extending the current study to future semesters, as well as other courses. Future research using the backward design process in holistic student development and assessment are recommended to develop and/or explore other assessment tools, and to further examine those used in this study. As external pressures for outcomes based education continue, particularly with a focus on providing evidence that performance levels have been achieved, this process allows educations to design courses to meet these demands.

CONCLUSIONS

This case study showed that student professional development can be impacted and measured in a higher education environment. Utilizing the backward design process provided a solid foundation in the successful creation of a valuable professional experience for the students. The inclusion of the industry-based 360-degree feedback process tool provided the means to measure the top five workplace competencies, and capture student experiences through self-reflection. This exempli-

FIGURE 7. CONTRIBUTION TO PROFESSIONAL DEVELOPMENT PHRASE RESPONSE FREQUENCY



fies the growing majority of workplace professional development expectations. Students believed they achieved professional gains, which prepared them for their future workplace endeavors and, for the researcher that implies success.

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