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# Crowdsourcing Management Education Assessment

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## ABSTRACT

*Assessment is now at the center of the new business education zeitgeist. This focus is the direct result of feedback from the business community regarding the growing gap between their needs and graduates from many business schools. Recently this divide has fallen under even closer scrutiny because of increasing student debt and the growing controversy over return-on-investment. Today business leaders are looking for web-savvy, problem-solving graduates. To this end, AACSB and regional accrediting bodies are calling for the adoption of comprehensive collaborative learning strategies to better align graduates' skill sets with the real needs of business. Crowdsourcing, which is the process of connecting students and faculty with a broad-based group of both internal and external resources, is receiving increased attention throughout the assessment community. Within this context, crowdsourcing broadens the resource pool and thus provides for improved quality assurance in terms of meaning, quality, integrity, accountability and transparency. The proposed crowdsourcing-based quality assurance strategy is illustrated using sample data from a recent MBA program assessment. This article also outlines how the crowdsourcing can be used to enhance student learning outcomes via specific implementation strategies.*

*Keywords: Assessment, Quality Assurance, Crowdsourcing, Business Education, Social Media*

## INTRODUCTION

Assessment can be defined as the process by which educational institutions measure learning outcomes against a set of specific goal and objectives. This process typically involves evaluating content coverage, learning modalities, program rigor and resource support. For the purposes of this paper, quality assurance is defined as a methodology for characterizing the effectiveness of a particular academic course or program. One promising approach for enhancing the assessment process is through the use of crowdsourcing (Howe, 2006). To that end, crowdsourcing via social media is beginning to see increased application throughout the higher education universe (O'Leary, 2015; Sharma, 2011; Solemon, 2014). Specifically, crowdsourcing can open up multiple options for adding new dimensions to learning and knowledge acquisition by allowing students to connect in both formal and informal learning settings. For example, it offers a forum for faculty and students to present their ideas and problem-solving abilities in front of an entire community, whereas these ideas are frequently lost in translation when transmitted through traditional institutional channels.

*Students must take ownership of their own learning in exchange for multiple modes of engagement in familiar online social venues. At the same time, students must accept communal responsibility and provide mentoring in a quid pro quo environment where payment is non-material. Empowered by proven techniques in social learning design and crowdsourcing, these new responsibilities promise more effective and efficient learning outcomes (Anderson, 2011).*

Crowdsourcing can enable students to hone their problem-solving skills by accessing a large pool of talent via the assessment process. This learning strategy is based on a collaborative and constructivist approach that enables students to more fully develop the skill sets needed to meet the evolving demands from the business community (Bruner, 2011; Thomas, 2012). The business community has embraced crowdsourcing as an important problem-solving vehicle for over a decade (Brown, 2014; Rogstadius, 2014).

The challenge of student learning assurance represents a key success factor in the future of management education, particularly as business schools continue the transition to online and blended programs. The following three learning paradigms offer a foundational framework for enhancing the assessment process within this expanding cosmos: 1) Formative Assessment Model (FAM), 2) Personal Learning Environments (PLE), and 3) E-learning Quality Assurance (EQL). FAM is predicated on achieving the cognitive demands of the learning objective(s) ensconced within the context of the lesson plan. Specifically, FAM is designed to characterize the depth and type of knowledge a learner will require to successfully complete a learning exercise (Seaton, 2013; Vendlinski, 2008). Immediate and ongoing feedback is a fundamental aspect of the FAM exemplar. PLEs represent a pedagogical approach for both integrating formal and informal learning and supporting students' self-regulated learning via social media. The evidence is growing that social media can facilitate the creation of PLEs that assist learners aggregate and share the results of learning achievements and participate in collective knowledge generation (Dabbagh, 2012; Wilson, 2008). EQL provides a structural framework for ensuring that content enhances learning and support learning goals, without distracting or detracting from the learning process (Buzetto, 2011). This assessment prototype is based on utilizing a variety of measurement protocols and not limited to multiple choice based exams.

*Recent commentators refer to notions of academia and practice as "closed systems and self referential" and point to the requirement for greater attention on knowledge transfer, and to learn from knowledge transfer studies concerning practitioner/research communities of practice, networks and collaborations (Harrington, 2011).*

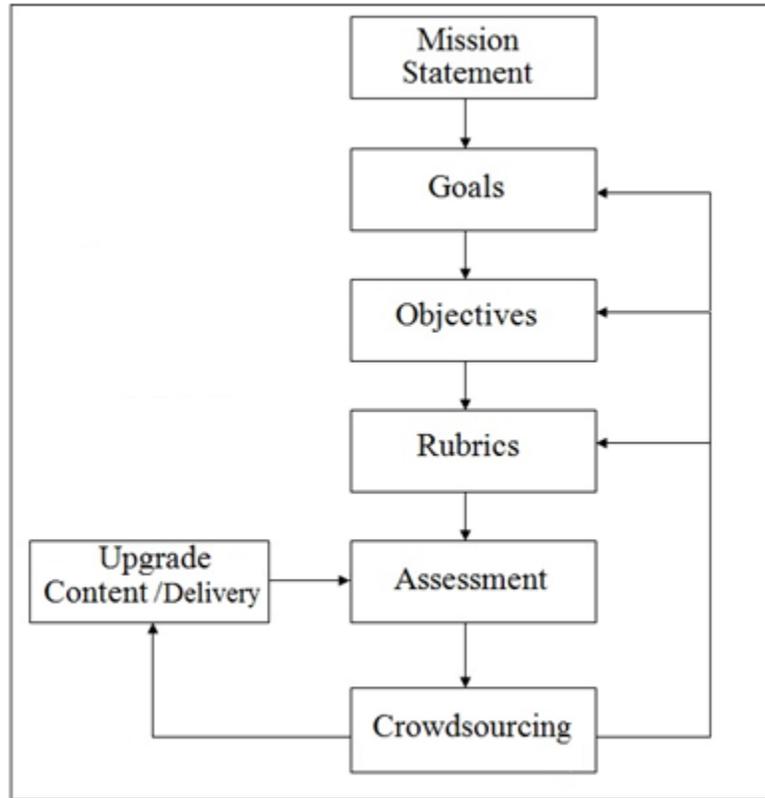
These three paradigms (FAM, PLE and EQL) form the scaffolding for applying crowdsourcing to the learning assessment and quality assurance processes. This paper is organized as follows: 1) a literature review on the opportunities for crowdsourcing-based assessment in management education, 2) an analytics-based evaluation of an MBA student database for the purpose of identifying and linking key assessment factors to individual student performance, and 3) a presentation on crowdsourcing-based assessment implementation strategies. This article's primary contribution to management education is to outline how the crowdsourcing assessment paradigm can be used to enhance student learning outcomes via specific implementation strategies.

*When you innovate, you've got to be prepared for everyone telling you you're nuts!*  
- Larry Ellison

## LITERATURE REVIEW

The practice of crowdsourcing is on the rise throughout both business and academe (Agafonovas, 2013; Gatautis, 2014). In an academic setting, crowdsourcing can enhance opportunities for students to access previously inaccessible intellectual capital as well as assist in the quality assurance process (Way, 2011). In this context, the expression “six degrees of separation” is an apt metaphor. First proposed in 1929 by the Hungarian writer Frigyes Karinthy, the six-degrees concept suggest that in a network, like the Web, users can connect with other users of the network through no more than five intermediates. This is the fundamental tenet behind crowdsourcing. Several assessments have been conducted on this theory, which have reasonably validated the six degrees estimate (Backstrom, 2012; Watanabe, 2013). This level of student and faculty access to the global body of knowledge becomes a powerful vehicle for enhancing learning opportunities and outcomes.

The increasing use of crowdsourcing in management education will provide students and faculty access to the wider educational community of practice. Specifically, students and student groups can contribute directly to online discussion forums and share work for peer review in a manner similar to the current practices of the business community (Mackey, 2011; Ralph, 2013). A key challenge is to identify the best crowdsourcing practices such that students are motivated to contribute and participate more in the learning process. Some key characteristics associated with the efficient use of crowdsourcing in an academic setting include (Monaghan, 2011): 1) Encourages self-forming and self-governing groups, 2) Shares common interest or learning goals among members, 3) Creates new knowledge, and 4) Promotes learning in a real-time context. For example, the networking and social communication capabilities of Facebook offer a greater number of learning styles, provide for real-time learning, help facilitate an online community of practice, and increase opportunities for faculty-student and student-student interactions. In that regard, business educators should expand their pedagogical portfolio, promote active learning through collaboration, and continue to assess the effectiveness of various social networks. The growing interest in quality assurance throughout the academic universe is not occurring by accident but by design. Business schools are under increasing pressure from both the business community and students to offer cost-effective programs (Jackson, 2012). The rising cost of higher education coupled with a stagnant job market continues to plague many recent graduates. The unemployment rate for new graduates is considerably higher than the national average. Furthermore, the level of student loan debt has reached an all-time high; in fact, it now exceeds both credit card and auto loan debt (Dynarski, 2014). Accordingly, many prospective students are becoming increasingly reluctant to enroll in a management education program in light of these challenges.



**Figure 1 – Crowdsourcing Quality Assurance Paradigm**

How can quality assurance help ameliorate these twin challenges? One potential solution is to expand student learning opportunities and enhance program performance outcomes via crowdsourcing. Figure 1 outlines the proposed crowdsourcing-based quality assurance process. The key addition to the traditional quality assurance model is the use of crowdsourcing to identify and capture specific content that can enhance learning opportunities and outcomes based on the assessment process. Crowdsourcing can also help establish new modes for delivering content and can assist in upgrading the goals, objectives and performance rubrics by reaching out to the business management universe (Cebrian, 2014). The formative assessment model, as outlined earlier, is designed to support this paradigm. Specifically, FAM provides session-to-session feedback and an inquiry-based action learning process (Melege, 2014). This process can often be facilitated through the use of social media. Among other things, social networks encourage students and student groups to work collectively with other groups on a global basis, which better prepares them for employment (Cao, 2013; Erenli, 2011). This increase in student engagement via social media, both in terms of depth and breadth, will enhance their appreciation for e-professionalism and personal learning networks (Borstnar, 2012).

Recent data suggests that crowdsourced peer-to-peer assessment (unlike self-assessment) offers ratings that are highly correlated with instructor assessment and demonstrate strong inter-rater reliability (Avery, 2014; Kishwar, 2015). Specifically, the results show that crowdsourced peer-to-peer assessments are perceived by students as fair and accurate. The goal of formative assessment is to monitor student learning to provide ongoing feedback that can be used by

instructors to improve their teaching and by students to improve their learning. More specifically, formative assessments help students identify their strengths and weaknesses, and target areas that need additional work. In a similar way, FAM helps faculty recognize when students are struggling and can provide immediate relief through the development of content collections by the community of practice. For the purpose of this article, formative assessment is defined as a process that provides ongoing feedback to the instructional pedagogy as a means to enhance student learning opportunities and outcomes (Popham, 2008). Typically, formative assessments are low-stakes processes in contrast to summary assessments, which tend to be very high stakes, such as final examinations.

*With the advancement of learning technologies used for assessment, effective pedagogical strategies should be adopted to expand learners' exposure to and involvement in online formative assessment activities so that they can achieve the intended long-term learning benefits such as critical reflection and self-regulated learning (Mao, 2013).*

To date, many business schools have established a center or department devoted to learning effectiveness and assessment (Garrett, 2012; Purvis, 2011). Typically, these centers provide guidance and support for the assessment cycle, institutional education objectives, and student learning outcomes. The center's primary function is to guide and facilitate the process of reaffirmation and accreditation. Given the importance of faculty engagement and inclusion, often the center's director is a faculty member, which helps to ensure that this function remains faculty driven as opposed to compliance or administratively driven. A standardized methodology for ongoing data collection and analytical methodology is typically formulated and implemented via the assessment center. Programs consistently use what is learned through assessment to implement changes and "close the loop." This process is used to trigger questions for further investigation rather than a compliance checklist. Therefore, the issues of meaning (how a standard is set and the interpretation of results), quality (measures of improvement and end results), and integrity (consistency in process and outcomes) are important (Beck, 2013). In this regard, the learning goals and objectives for each program should be closely aligned with the school's mission. Some goals are common across multiple programs. However, since each program is designed for individuals at different points in their careers, some goals are unique to each program. Goals and objectives as well as a curriculum matrix mapping the assessment across each program should be published online.

The overall learning assessment process examined in this study consisted of four goals, with each goal containing three to four objectives, which is consistent with AACSB's five-step Assurance of Learning Standards (AACSB, 2013). To keep the analysis manageable, Goal #1 was selected for a more detailed evaluation. A standard three-point scale rubric was used (Feldman, 2011; K. Wolf, 2007). Table 1 highlights assessment Goal #1 and the corresponding set of objectives. Again the purpose of this analysis was to demonstrate how to develop useful analytics-based relationships between student characteristics and assessment outcomes.

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Goal #1: *Students have the skills to analyze business situations in an integrated, multi-disciplinary way and recommend solutions.*

Objective #1: Students recognize the importance of multi-disciplinary problem solving.

Objective #2: *Students engage in multi-disciplinary problem solving.*

*2.1 Apply integrative thinking and analysis*

*2.2 Demonstrate quantitative skills*

Objective #3: Students develop and justify strategic recommendations that indicate the integration of a variety of business functions.

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\* Each objective is measure on a three-point scale: E= Exceeds expectations, M = Meets expectations, D = Does not meet expectations.

### **Table 1: Assessment Goal #1 and Objectives.\***

The corresponding objective scores range from one (does not meet expectations) to two (meets expectations) to three (exceeds expectations). The maximum value for Goal #1 is twelve. The example hypotheses for this example data analysis, based on the literature review and the assessment goal, are as follows:

- H1: Incoming GPA is correlated to Goal #1
- H2: Work experience is correlated to Goal #1
- H3: Delivery mode (Online/Traditional) is correlated to Goal #1
- H4: Admission waiver is correlated to Goal #1
- H5: Quantitative oriented courses are correlated to Goal #1
- H6: Time in program is correlated to Goal #1

These hypotheses are simply illustrative of a broad range of possibilities. In some instances incoming students could apply for an admissions waiver in lieu of taking the GMAT. Waivers were typically granted based on a combination of work experience and a STEM undergraduate degree. The Goal #1 student assessments were made by the faculty near the end of each term.

## **EXAMPLE DATA ANALYSIS**

To illustrate the process outlined above assessment data was collected on 251 students engaged in a fully employed MBA program at a major business school. Some specific characteristics of the program were: 1) small classes with 30 students or less; 2) close and ongoing student-faculty engagement; 3) students with significant work experience; and 4) a growing network of courses, students and faculty online (e.g. blended). The resultant survey data revealed that approximately 12 percent of the students in the sample failed to meet the expectations associated with Goal #1. Similar proportions were observed for the three individual objectives. Table 2 highlights the various model variable mnemonics and corresponding descriptive statistics for the assembled database. Traditional delivery is defined as primarily in-class instruction. The statistics reported

in Table 2 reveal, for example, that 44 percent of the database consisted of women and that the average working experience was on the order of eight years. These statistics are consistent with their overall proportions in the MBA program. The target variable (Expt) was re-characterized as a dummy variable (1= meets or exceeds expectations, 0 = does not meet expectations).

Mnemonic	Definition	Mean	S.D.
Delivery	Online=1, Traditional=0	0.70	-
Quant	Quantitative course=1, Other=0	0.88	-
Work	Years of Working Experience	8.00	5.00
IGPA	Incoming Grade Point Average	3.15	0.44
Wave	Wavier=1, other=0	0.54	-
Gender	Female=1, male=0	0.44	-
Period	2 <sup>nd</sup> year student=1, 1 <sup>st</sup> year student=0	0.73	-
<b>Expt (target)</b>	<b>Expectation Level-Goal #1*</b>	0.88	-

\*1 = meets or exceeds expectations, 0 = does not meet expectations

**Table 2: Selected Variable Mnemonics and Descriptive Statistics (N=251).**

	IGPA	Work	Expt
IGPA	1		
Work	0.02	1	
Expt	0.15*	0.06	1

\* Significant at the 0.01 level

**Table 3: Correlation Matrix (Kendall- Tau). \***

Table 3 reports the Kendall-Tau correlation coefficients for the continuous predictor variable set and the ordinal target variable Expt. The correlation data revealed that incoming GPA is statistically significant at the 0.01 level as related to Goal #1.

An analytics-based modeling approach was used to more fully explore the assembled database. Analytics is the science of discovering and communicating meaningful patterns in data and developing actionable plans and is seeing increased use throughout academia including in learning assessment. More specifically, learning analytics is the process of measuring and analyzing data about learners and their contexts (Abdous, 2012; Moxley, 2013). In the former analysis, the results show that using educational data mining techniques provides a strong and coherent analytical framework capable of enabling a deeper and richer understanding of students' learning behaviors and experiences. In the later study, the findings suggest that the use of analytics based-rubrics helps facilitate a higher level of inter-reliability among instructors, illustrates ways a curriculum affects student success, and measures the level of difficulty of specific projects for student cohorts. In many similar educational assessment applications ordinal logistic regression (OLR) is often the method of choice (Dignath, 2012; Romero, 2010). However, the relatively small sample size (N=251), coupled with the relatively small portion of students that did not meet expectations (12

percent) called for more robust analytical methods. Accordingly two more powerful analytics techniques were employed: neural nets (NN) and classification regression trees (CART). Again the purpose of the paper is not an assessment of candidate methodologies, but simply to highlight how performance data can be used to support the assessment process.

### ***Neural Nets (NN)***

Neural Networks (NNs) are a branch of artificial intelligence that addresses the problem of analyzing and forecasting data by simulating the biological neural network found in the human brain. NNs use complex network relationships to mimic the connections between sets of data and have the advantage of not requiring prior assumptions about possible relations, as is the case with traditional analysis methods, such as regression. The architecture of an NN consists, at a minimum, of two layers: an input neuron or neuron layer and an output neuron. The values for the input states may come from the activation of other neurons or specific environmental factors. The example numerical value inside the nodes represents the threshold value for firing or activating the neuron. The values for the weights and thresholds are determined through an iterative process with the goal of minimizing the aggregate error. Neural networks have seen increased use in educational classification studies (Herzog, 2006; Oladokun, 2008). The NN classification analysis was conducted using the NeuralShell Classifier, by the Ward Systems Group.

### ***Classification and Regression Trees (CART)***

Classification and Regression Trees (CART) have also seen considerable application in the educational field (Baradwaj, 2011; Kirby, 2014). CART is a non-parametric analytical procedure that generates variable based structural trees: 1) classification trees when the target variable is binary and 2) regression trees when the target variable is continuous. Trees are formed by a collection of rules based on values of certain variables in the modeling process. Rules are selected according to how well splits based on variables' values can differentiate observations of the dependent variable. Once a rule is selected and splits a node into two, the same logic is applied to each dependent node. The splitting process is terminated when no improvement in the model's performance can be achieved. Each branch of the tree ends in a terminal node. The data observations fall into exactly one terminal node. A terminal node is uniquely defined by a set of rules. Typically, CART results are more understandable compared with OLR and the tree logic makes it easier to apply model outcomes. Furthermore, the model is extremely robust regarding the effect of outliers. The data-splitting nature of the decision rules allows the model to distinguish datasets with different characteristics and hence to neutralize outliers in separate nodes. The CART classification analysis was conducted using the Predictive Modeler, by Salford Systems.

### ***Results Assessment***

A classification analysis of the assessment database using both NN and CART is highlighted in Tables 4 and 5, respectively. Typically, a portion of the database is used to train the model and the remaining data is used for predictive or classification purposes. Often an 80 percent to 20 percent ratio (training to holdout) is used. However, the relatively small sample size precluded this approach, which often results in over-optimistic model performance (Picard, 1984). Sample sizes on the order of 1,500 or more with a holdout group of 25 percent is the minimum database

requirement for effectively "testing" the model, especially if there are multiple categories (Nguyen, 2001).

	Actual 0 <sup>1</sup>	Actual 1 <sup>2</sup>	Total		
Predict 0	29	52	81	36%	PPV <sup>3</sup>
Predict 1	0	170	170	100%	NPV <sup>4</sup>
Total	29	222			
	100%	77%			
	Sensitivity	Specificity			

<sup>1</sup> Does not meet expectations, <sup>2</sup> Meets or exceeds expectations,

<sup>3</sup> Positive predictive value, <sup>4</sup> Negative predictive value

**Table 5: NN Classification Analysis.**

	Actual 0	Actual 1	Total		
Predict 0	28	38	66	42%	PPV <sup>3</sup>
Predict 1	1	184	185	99%	NPV <sup>4</sup>
Total	29	222	251		
	97%	83%			
	Sensitivity	Specificity			

<sup>1</sup> Does not meet expectations, <sup>2</sup> Meets or exceeds expectations,

<sup>3</sup> Positive predictive value, <sup>4</sup> Negative predictive value

**Table 6: CART Classification Analysis.**

In the context of this study, a positive predictive value is the probability that a student classified as not meeting expectations will not meet expectations. In contrast, a negative predictive value is the probability that a student was classified as meeting expectations when they will actually not meet expectations. The results for both models suggest that very few students who will need an intervention will be missed. Again the purpose of these discussions is to illustrate an analytics-based approach for identifying students at risk which is at the core of the assessment process.

Variable	NN	CART
IGPA	0.46	100
Work	0.48	35
Delivery	0.06	12
Waiver	0.01	4

**Table 7: Relative Variable Contribution (Goal #1).**

Table 7 presents the relative impact of the candidate predictor variables for the two modeling approaches. The outcomes for the NN model suggest that both IGPA and Work have about the same relative impact on the target variable, while the CART results suggest that IGPA is far and away the most important factor in identifying potential students at risk. Interestingly, the granting

of a waiver, based on work experience, as a substitute for the GMAT does seem to play a very important role. The relative importance of IGPA as a predictor of student performance in graduate management education is consistent with similar studies (Christensen, 2012; Howell, 2014). Table 8 highlights the results of the hypothesis assessment.

**Table 8 – Example Hypothesis Summary (Goal #1)**

Hypothesis	Conclusion
H1: Incoming GPA is correlated to Goal #1	Supported
H2: Work experience is correlated to Goal #1	Supported
H3: Method of delivery is correlated to Goal #1	Marginal
H4: Admissions waiver is correlated to Goal #1	Marginal
H5: Quantitative oriented courses are correlated to Goal #1	Not Supported
H6: Time in program is correlated to Goal #1	Not Supported

The results from the above discussion outline an approach for relating student characteristics (e.g., work experience) to learning assessment outcomes. These relationships can be used for identifying additional customized learning resources via crowdsourcing for students that are struggling or in some cases that require an instructional intervention (Kirkwood, 2014). However, recognizing the potential of this methodology is only the first step. Of equal importance is the design of implementation strategies.

## ASSESSMENT IMPLEMENTATION STRATEGIES

Engaging faculty, educational researchers, and administration in the crowdsourcing-based paradigm is essential for ensuring success in the assessment process. This is particularly the case for learning outcomes involving multi-disciplinary problem solving, e.g., Goal #1. Typically, faculty members are tasked with filling out the assessment template. There are a number of factors that need to be addressed so that the faculty can successfully engage in this activity, including: training, development, and incentives (Brooks, 2010; Dellabough, 2013). Faculty-driven collaboration networks can help facilitate the adoption of the proposed assessment strategy through access to community best practices. Specifically, a management education collaboration network provides the business education community with the opportunity to converge, share, and exchange ideas to drive innovation in student learning and assessment (Mason, 2012).

*Students must understand and use learning targets, set their own learning goals, select effective learning strategies, and assess their own learning progress. And as students develop into more confident and competent learners, they become motivated (energized) to learn, increasingly able to persist during demanding tasks and to regulate their own effort and actions when they tackle new learning challenges (Moss, 2010).*

Presented in the following are several examples of how social networks foster learning and leverage crowdsourcing.

## Self-Regulated Learning

This approach is an active constructive process whereby learners set goals for their learning and monitor, regulate, and control their cognition, motivation, and behavior, guided and constrained by their goals and the contextual features of the environment.

*Question Walls represents a distinct discussion forum in the online learning environment that can feature different questions from students and instructors. The main rationale behind using such an interactive tool is to allow students to create discussion threads based on topics of interest to them, both related to the class content as well as its co-requisites and more general issues. One reason Question Walls works well is the fact that traditional divisions between instructors and students disappear, thus enhancing online communication and interactivity (Vonderwell, 2013).*

## Formally Structured Learning (From Content to Competency)

Students are guided to establish their analytical approach as a warm-up to a formally structured face-to-face session scheduled to take place a few days or hours later. This process is often known as just-in-time learning (Baruah, 2013). Figure 2 illustrates how students are engaged in a preliminary exercise as a warm-up to a formally structured face-to-face session. While this type of questioning is also typical of online discussion boards, the data shows that student responses tend to be more to-the-point and conversational. Because this format of social network discussion threads is now quite common, students tend to actually read, respond, and learn from each others' posts. This kind of constructivist learning also engages the student as an active participant (Hwang, 2013).

► ISTM476.41 IS in Biz Spr11 @: Wk5 Q1a. In Chapter 2 of your text, you learned about Porter's Five Forces. Pick one of the forces and describe how it has, does, or will give Netflix a competitive advantage. [NOTE: If all five forces are already discussed and you have nothing new to add, then answer question Wk5 Q1b.]  
9:58 PM - Feb 2 · Reply · Like · More

Show 4 older replies >

 [redacted]: I'll take Porter's "Power of buyers." In the case of Netflix one of their competitive advantages is their Cinematch program. Accurately recommending movies that fit their clients viewing preferences. It allows Netflix to have a very low churn rate, in essence it creates a "cost" for their clients to switch to a rival. Each day more movies are rented and more ratings are added which continues to make the Cinematch program more and more accurate. In addition to Cinematch, the almost endless list of movies that Netflix has access to satisfies their clients' need for choices. Combine the sheer number of movie titles available, lack of late fees (lower costs), and convenience and the buyer has power.  
10:11 PM - Feb 6

 [redacted] power of suppliers is Netflix's biggest advantage. The other forces are very weak. there can be many substitutes, easy to rival and substitute and new entry is not very costly. The suppliers being the movie industry have a contract with Netflix and an existing relationship. This gives Netflix a huge advantage because there were there first. However, this tide can shift quickly. As more mobile devices, tablets, wireless networks, and technology change, it will demand Netflix to be on the top of its game to continue growth.  
8:58 AM - Feb 7

Figure 2 – Example Case Study Warm-up Question and Responses

### **Case Study Warm-Up Question and Responses**

Core concepts are reinforced when students are able to relate their course readings to not only their own experiences, but also those of their classmates'. In seeing their classmate's contributions recognized by their professor as valuable, they too are motivated to share their related experiences (Klingerberg, 2012). Other strategies to help generate and collate quality information about student learning include: 1) Students requesting the feedback they would like when they make an assignment submission (e.g. on a pro forma with published criteria), 2) Students identifying where they are having difficulties, and 3) Student groups defining additional areas for extra support (Nicol, 2006). For all of these strategies, results can be measured "in vivo" as the faculty member evaluates those involved in the conversations, their contributions and can even measure skills developed over-time. By being engaged themselves in these interventions, using data based on the assessment process the faculty member can personalize and guide students who are specifically at risk.

### **Implementing Crowdsourcing-Based Assessment and Learning**

The above examples illustrate how crowdsourcing can be used in both the learning process and in designing interventions. Some reasons these interventions appear so promising include: 1) Enables quick engagement of the student in a self-directed way; 2) Learning inputs involve not only the faculty member but peers ensuring complex content and often quicker internalization; and 3) Online format ensures measurable results and quicker calibration by the instructor.

Presented here are some guidelines for implementing the proposed assessment system (J. Wolfe, 2014):

- **Early success:** Learning innovations, like crowdsourcing, are most likely to be accepted and used by the majority of management educators if success is experienced early on. Early on success extends to the peer network, both within and outside the institution, thereby magnifying the impact on adoption and diffusion.
- **On-going peer support:** Complementing the experience of initial success, there should be ample "hand-holding" along the way of integration as other applications are introduced. Live peer support not only serves as assistance and encouragement; but also it contributes to the person-to-person communication that promotes diffusion throughout an educational community.
- **Real task activities:** Many management educators see technology in terms of helping address real problems. Initiatives designed to introduce and use learning technology should address real task activities and requirements.
- **Challenges:** The adoption of a crowdsourcing-based assessment system is predicated on a number of factors including ease of use, functional value, costs and membership access. The continuous evaluation of the collaboration readiness level of members provides focus, feedback and learning to support continuous improvement of the organizations' capability to cooperate and collaborate.

Implementation of the proposed crowdsourcing-based quality assurance strategy requires a broader view of assessment beyond simply measuring student learning. Faculty and students need to take ownership of the process. Faculty must understand the importance of classroom level calibration, the methodologies to achieve this and the larger questions that business schools are asking based on assessment outcomes. In the current study, the learning goal was that students would develop a deeper understanding of multi-discipline problem solving. This goal was developed with both internal and external inputs. To support this process, faculty must be engaged in classroom-based strategies to assist and measure student performance and ultimately success. To this end, a number of research efforts are underway on ways business schools can leverage crowdsourcing-based assessment to facilitate student learning and success (Zhao, 2014).

## CONCLUSIONS

This article outlines how the crowdsourcing assessment paradigm can be used to enhance student learning outcomes via specific implementation strategies. The proposed crowdsourcing assessment template is based on the following three learning paradigms: 1) Formative Assessment Model, 2) Personal Learning Environments, and 3) E-learning Quality Assurance. The crowdsourcing-based assessment strategy is illustrated using sample data from a recent MBA program assessment. The primary objective of this demonstration was to highlight how to develop relationships between student performance characteristics and assessment outcomes. Among other things, these relationships can be used to identify students at risk so that a specific crowdsourcing-based intervention can be implemented and adjustments in the overall learning process can be facilitated. This feedback mechanism also teaches the process of knowledge management and constructivist learning, which a business student will be using in the workplace. To that end, faculty can decide how to enhance learning by mapping these contributions onto a desired process focused on specific learning outcomes. Not only does this crowdsourcing process build learning capacity in the student, it is also highly measurable and feedback is immediate. The downside is the time-intensive nature of this process. Overall, the process outlined in this paper presents a different approach to learning assessment, which is more aligned with 21<sup>st</sup> century business practice. Specifically, it facilitates the use of crowdsourcing to help identify and fill the dynamically changing gaps between business needs and the skill set of business graduates. To that end, further research is needed in identifying additional student performance factors and in developing programs for faculty training in crowdsourcing based assessment.

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