AC 2011-840: ASSESSING THE EFFECTIVENESS OF ENTREPRENEURIAL EDUCATION PROGRAMS FROM A MULTI-LEVEL MULTI-DIMENSIONAL PERSPECTIVE WITH MENTAL MODELS

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Assessing the Effectiveness of Entrepreneurial Education Programs from a Multi-level Multi-dimensional Perspective with Mental Models

Abstract

Entrepreneurship education programs typically include a large range of student outcomes including knowledge, skills, and attitudes as well as outcomes that go beyond the classroom. Because of the extent of inclusions and the broad range of effects, assessing the effectiveness of entrepreneurship education programs is frequently challenged. Based upon Block and Stumpf [1]'s idea of "hierarchy of criteria" for evaluation, the main purpose of this research is to provide a multi-level multi-dimensional perspective that systematically investigates factors related to the success of entrepreneurship education programs. Such programs, in turn, can stimulate and bring success to new enterprises and entire communities.

The authors propose a multi-level multi-dimensional perspective for assessing the effectiveness of entrepreneurship education programs while introducing a measurement model as a critical component. The effectiveness of entrepreneurial education programs is difficult to measure precisely, particularly in a shorter time, due to the nature of entrepreneurship education program outcomes which researchers need to wait years before students graduate and then contribute to the creation of innovation or new venture in their later carrier. According to Rouse and Morris [2], mental models are the mechanisms whereby humans generate descriptions of system purpose and form, explanations of system functioning and observed system states, and predictions of future system states. Consequently, a mental model plays a major role in entrepreneurship mindset because mental models profoundly influence one's beliefs, intentions, and behaviors.

In this paper, first, the authors introduce three major problems associated with assessment of entrepreneurship education programs. Second, the entrepreneurship education program at the small engineering school is presented. Third, the authors provide a more comprehensive assessment model of entrepreneurship education programs to inform and direct stakeholders of entrepreneurship education programs. We suggest that the multi-level multi-dimensional perspective would be more empirically testable for interactions between the students, his/her teachers, relationships within the institution, and the society and economy, by adding the shared mental model construct into the research model.

Keyword: Entrepreneurship Education, Program Evaluation, Multi-level Multi-dimensional Model, HLM

Introduction

Over the past two decades, there has been an increasing interest in entrepreneurship education program among engineering schools due to the increasing demand from students as well as increasing resources supplied by external stakeholders such as the Kaufman Foundation and the Kern Foundation. Consequently, a growing number of studies have been devoted to evaluating the impact of these programs. However, due to the large range of topics including knowledge,

skills, and attitudes and broad range of effects as well as impacts that go beyond the classroom, assessing effectiveness of entrepreneurship education programs is frequently challenged.

In this evaluation, three major problems have been often noted. The first problem comes in timely evaluation. Timely evaluation of the effectiveness of the entrepreneurial education programs is critical because these programs are expensive in both money and time for the participants as well as the external stakeholders [5]. Program evaluation is different from general research in its overall purpose. A program evaluation study could change or make better the very thing that is being studied while a main purpose of a general research study is to expand the general understanding of knowledge about the topic and ultimately to inform practice. It is important to determine if a particular program is effective early in order to minimize the opportunity cost of missed improvements to the program. There is a broad array of options available to foster entrepreneurship and economic development, and not incidentally, educate students who aspire to become entrepreneurs [6].

The second problem is attributed to the nature of the hierarchical, or nested, data structures of the entrepreneurship education program. Students in educational settings exist within a hierarchical social structure that includes peer group, classroom, grade level, school, school district, state, and country [4]. Since academic institutions commonly embed students in peer groups, and peer groups are embedded within classrooms, it is difficult to measure directly the effectiveness of entrepreneurship education programs while screening out interactions from other factors than the effects of entrepreneurship education programs. Also, in this nested, hierarchical structure of an entrepreneurship education program, program level factors may have direct or moderating effects on the outcomes of students. Individual students' outcomes as micro phenomena are embedded in macro contexts such as peer group, classroom, and school. In turn, macro-level variables often have an effect on individual student outcomes through the interactions and dynamics of micro-level elements. Thus, no single-level model can adequately provide a holistic account of student outcomes of entrepreneurship education program because only limited conclusions can be drawn from a single-level perspective.

The third problem is the timing of measure. The ultimate impact sought from entrepreneurial education programs is the creation of an entrepreneurial mindset among the students. In order to measure whether the program creates entrepreneurial mindset among the students properly, the researchers may need to wait years before the students graduate and then contribute to innovations or new ventures in their later careers. This is not an option from the program evaluation perspective. Faculty need to assess the effectiveness of the program immediately in order to report to the stakeholders or participants for the purposes of changing the program if it is necessary.

Generally, the effectiveness of entrepreneurial education program is difficult to measure precisely, particularly in the short time frames that stakeholders are typically looking at. Stakeholders are eager to see immediate returns from their investments. Based upon Block and Stumpf 's [1] idea of "hierarchy of criteria" for evaluation of entrepreneurship education programs, the main purpose of this research is to provide a multi-level multi-dimensional perspective that systematically investigates factors related to the success of entrepreneurship

education programs. This success, in turn, can lead to the stimulation and success of new enterprises.

While the authors propose the multi-level multi-dimensional perspective for assessing effectiveness of entrepreneurship education programs, the authors introduce a measurement of mental model as a critical component of the model. According to Rouse and Morris [2], mental models are the mechanisms whereby humans generate descriptions of system purpose and form, explanations of system functioning and observed system states, and predictions of future system states. Consequently, a mental model plays a major role in entrepreneurial mindset because one's mental model profoundly influences one's beliefs, intentions, and behaviors.

The remainder of the paper is organized as follows: After the introduction of the entrepreneurship education program at the small engineering school is presented, this manuscript discusses 1) what to measure and 2) how to measure the effectiveness of the entrepreneurial education programs as well as to make recommendations in time. We suggest 1) multi-dimensional outcomes for what to measure and 2) multi-level perspective for how to measure while we add measurements of mental model into a more comprehensive assessment model of entrepreneurship education programs to inform and direct stakeholders of entrepreneurship education programs. Finally, in conclusion section, the research model and its contributions are discussed followed by preliminary analysis results.

The Entrepreneurship Program

The entrepreneurship program that this article explores is in the context of a small, private engineering focused university in Michigan. A large corporation originally owned the institution before it became private in 1982. The institution employs a co-operative model of engineering education with students completing alternate terms of work and study. Currently, the university works with over 600 co-operative employers that employ its students. During this time, student co-op experiences have become much more diverse and now range from work with large corporate to small entrepreneurial employers. This transition, along with a general trend in engineering education to focus on innovation, is a strong motivator for the institution to incorporate entrepreneurial education in its programs.

The institution received its first Kern Family Foundation grant in 2006. This grant led to the creation of an elective course for entrepreneurship. The Kern Family Foundation awarded a second grant in 2007, which allowed the institution to continue the academic class and create a minor in entrepreneurship. Like others, the institution expanded its entrepreneurial curricular and co-curricular activities beyond the academic class during the period of 2007-2008. Students organized an Entrepreneur Society, to help each other start their own businesses. The Business Department filled an endowed chair with an entrepreneur from industry. The institution started sponsoring a business plan competition where students compete for prize money to begin their businesses. The institution also started hosting a government funded regional Small Business Technology and Development Center.

In late 2008, the institution initiated a new entrepreneurship education program around a concept called "Entrepreneurship Across the Curriculum" (ExC) which is also sponsored by Kern Family

Foundation. Like other such programs as "Writing across the curriculum," it attempted to infuse the concepts of entrepreneurship in engineering and science disciplines. The program intent is to provide students exposure to entrepreneurship throughout their academic and cooperative education experience and in turn to create an entrepreneurial mindset.

In late 2009, a plan to teach entrepreneurship across the university (EAU) was formulated. As in ExC, we offer a professional development program in EAU. The professional development program is offered not only to faculty but also to staff members in order to ensure the maximum exposure of entrepreneurship to the student body. EAU focuses on incorporating entrepreneurship into the culture of the institution, which also leads a radical and beneficial change in the manner that students think about the future. If there is any result in student outcomes from the entrepreneurship education practices, the stakeholders of the program need to understand how students reach an entrepreneurial mindset.

What to Measure: Multi-dimensional Outcomes

One can define a program as a set of specific activities designed for an intended purpose, with quantifiable goals and objectives [7]. According to the Kern Foundation, the main goal of the entrepreneurship education program is to develop technical leaders with strong skills and an entrepreneurial mindset in undergraduate engineering programs. In order to determine the effectiveness of a program and to make recommendations for programmatic refinement and success, first, we need to select a practical and valid outcome measure that we can repeatedly assess over time. Outcome measures useful for our program evaluation must possess several features such as the properties of reliability, validity, and sensitivity to change.

However, measuring the ultimate impact sought from the entrepreneurial education programs (i.e., the creation of entrepreneurial mindset among the students) is neither clear nor straight-forward. In order to measure whether the program create entrepreneurial mindset among the students properly, researchers perhaps need to measure multiple outcomes. Entrepreneurship education programs include a large range of topics including knowledge, skills, and attitudes as well as impacts of such programs go beyond classrooms. Because of the extent of inclusions and the broad range of effects, assessing effectiveness of entrepreneurship education programs should be multi-dimensional.

Table 1 shows the conceptualization of our recommendation for outcome measures. The authors must acknowledge from the beginning that outcome measures could be flawed. However, from the program evaluation perspective, attempting to choose "best-supported" measures needs to be properly tempered with pragmatic consideration. If the best measure is too expensive (or not available in time), then it is reasonable to consider the next best or "best-supported" [8].

Table 1 Multi-dimensional Outcomes of Entrepreneurship Education Programs

Outcome Dimension	Description
Behavioral	Behaviors such as being an entrepreneur and participating entrepreneurial activities such as creating a new venture.
Cognitive	Knowledge about the entrepreneurship and business acumen sometimes as declarative knowledge, verbal knowledge, knowledge organization, and cognitive strategies.
Affective	Motivational outcomes such as self-efficacy, goal level, and goal commitment, and satisfaction for the entrepreneurship education program.
Attitudinal	Attitude direction and strength toward the targeted behaviors (e.g., being an entrepreneur)
Skill-Based	Proficiency to use the entrepreneurship knowledge and business acumen, referred as procedural knowledge, skill compilation and automaticity

Currently, the authors do not have any outcome measure for the Behavioral Outcome Dimension. However, it is commonly believed that behavioral intention could be a good surrogate for behavior. The authors employ Intention to Start a Business (ITSB), a 5 item measure adapted from Chen et al. [11] to measure student behavior intention. The authors also employ Entrepreneurial Self Efficacy (ESE) – a 22 item measure that speak to "the strength of an individual's belief that he or she is capable of successfully performing the roles and tasks of an entrepreneur" and Locus of Control (LOC) - Locus of control refers to how individuals attribute the results of their lives to internal or external forces from the et al. [15]. The authors also have begun to survey students in class sections exposed to entrepreneurial content on the extent of their exposure. Using a five-point scale that ranges from simple exposure to immersion, students evaluate their exposure to creativity, entrepreneurial attitude and entrepreneurial tasks.

The authors expand our measure for student attitudes from formative measures in a single course to a summative measure across a student's university years. The authors measure student attitudes at both the freshmen and senior level using an instrument developed by Kingston University in the United Kingdom [12]. The survey asks 36 questions of students in six categories (creativity, leadership, problem solving, project work, career control and financial risk) regarding their attitudes toward entrepreneurship. The authors administer this measure at the freshmen and senior level.

Beyond the measures for the student, the authors created measures for faculty and staff member attitudes in the professional development workshops that are based upon Timmons and Spinelli work [13]. For each of eleven attributes the instrument measures faculty self-efficacy (do faculty feel able to teach key entrepreneurship attributes), faculty willingness to teach key entrepreneurial attributes and faculty belief in the necessity of teaching key entrepreneurship attributes to students.

The authors try to cover all five dimensions of outcome measure by providing multiple measures. Also, it can be noticed that the authors provide direct measures for the program itself

as well as indirect measures. Not that some researchers believe that trainees' reactions to the training program have to do more with the evaluation of the training program and cannot be considered as an outcome of training [14]. In other words, although organizations design training such that trainees will be satisfied with the program, the primary goal of training is to develop trainees' skills and motivation to use the system. Outcomes should measure the extent of accomplishment of these goals.

The authors recognize the limitation of our efforts to date in measuring "entrepreneurial mindset." In a new effort to measure it more objectively, the authors are working to develop an improved "mental model" measure. The authors will start by studying a group of experienced entrepreneurs. Using recent research literature on mental models, the authors will use this information in the development of a new survey instrument to use with students. Mental models allow people to understand and interpret phenomena, to draw inferences, to decide what actions to take, to control system execution, and make predictions [16]. The reason why the authors are interested in measuring shared mental model is that they can be a good performance indicator for our programs. The ultimate outcome sought from our entrepreneurial program is to create an entrepreneurial mindset among our students that contributes to innovation or new venture creation in their later careers. By measuring shared mental model between successful entrepreneurs and the students, the authors believe the authors can assess whether our program creates an entrepreneurial mindset among the students now rather than wait years to see what students actually do.

How to Measure: Multi-Level Model

In a university, students are commonly embedded in classes, and classes are embedded within the university (see Figure 1). There are several problems with hierarchical, or nested, data. First, students within a single class tend to be more similar to each other than randomly sampled students from the entire student population are. This is because students are not randomly assigned to classrooms and some factors of the class such as subjects of the class make the students enroll in the class. Thus, students in a given class tend to come from a community segment that is more homogeneous than the overall population. Further, students within a given class share a common experience in the same environment – the same physical environment, same teacher and nearly identical experiences, which likely leads to increased homogeneity over time. Because students typically share certain characteristics (background, environmental, experiential, demographic, or other), observations based on these individuals are likely not fully independent. Most analytic techniques, however, require as an assumption independence of observations for analysis. Because this assumption is violated in the presence of hierarchical data, any single level analysis leads to a higher probability of rejection of a null hypothesis.

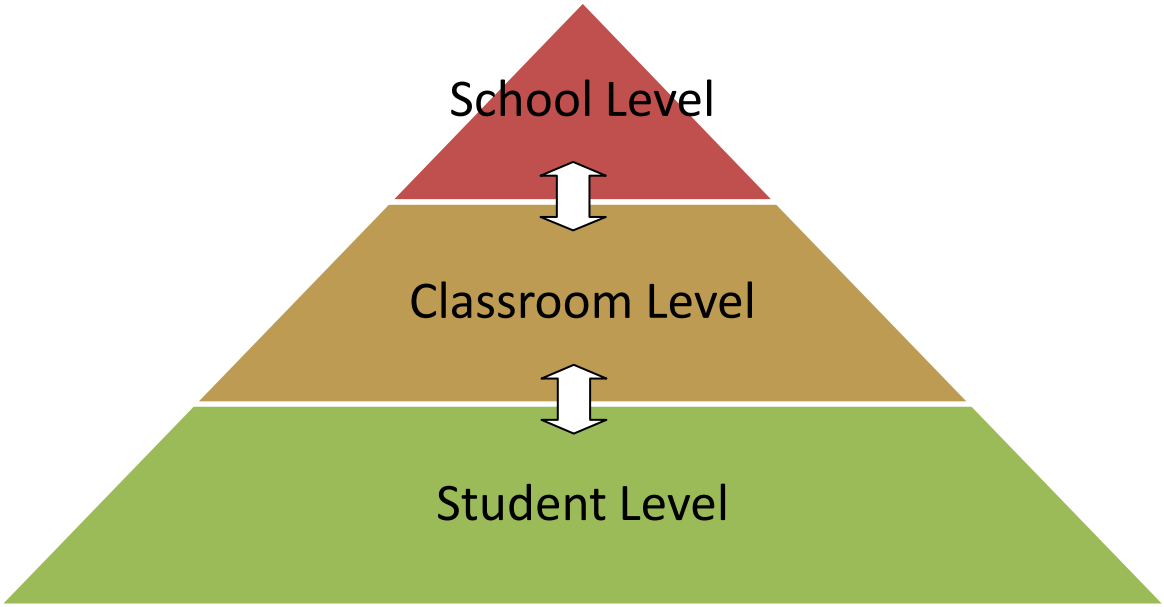

Figure 1. Hierarchical Nature of the Entrepreneurship Education Data

In this program evaluation, the authors are interested in understanding how the entrepreneurship education program and other environmental variables (e.g., teaching style, teacher attitude toward entrepreneurship, etc.) affect student outcomes. Since the authors gather outcomes at an individual level, and other variables at classroom level, one can question what the proper unit of analysis should be, and how one should deal with the cross-level nature of the data.

One strategy that could be taken is to assign the same classroom characteristics to all students in a class (i.e., bringing higher-level variables down to the student level). The problem, again, with this approach is non-independence of observations, as all students within a given classroom assume identical scores on each variable. Another approach to deal with this problem is to aggregate up to the level of the classroom. Thus, the authors could talk about the effect of classroom or teacher characteristics on average achievement for the entire class. However, there are a number of issues with this approach, including: (a) the authors lose much (perhaps up to 80-90%) of individual variability on the outcome variable, which can lead to significant under- or over-estimation of observed relationships between variables [10], and (b) outcome variables change significantly and substantively from average classroom achievement to individual achievement.

In dealing with nested data, which includes both class level variables and student-level variables, traditional regression approaches model all effects to occur at a single level, either aggregating individual-level variables to the collective level or disaggregating collective level variables to the individual-level, thus introducing serious biases in estimating regression coefficients. In order to overcome this limitation, the authors recommend using a multi-level model so that the authors can employ Hierarchical linear modeling (HLM, also known as multilevel analysis) as an advanced form of regression analysis. HLM captures systematic variability at both levels, allowing one to analyze variance in the dependent variable at multiple levels without artificially flattening the levels, and thereby allowing the variables to be more accurately reflective of the

multilevel phenomenon. HLM originated in the mid-1980s in the fields of educational measurement and sociology and has been applied to other domains as the idea of individuals or objects, nested in groups, can explain additional variability of a phenomenon [9]. HLM is a regression-based approach that allows a hierarchical partitioning of variance. HLM provides a way for examining higher-level effects on lower-level relationships. Researchers typically use HLM in models where the independent variables exist at multiple levels, and the dependent variable is at the lowest level of analysis.

Empirical Results

The authors will present results of empirical work using HLM and multi-level model proposed in this paper at the conference.

Conclusion

In conclusion, this paper proposes a multi-level multi-dimensional model for program assessment of entrepreneurial educational programs that seek to instill entrepreneurial mindset into students. A multilevel approach combined with multi-dimension seems promising in the program evaluation perspective (see Figure 2).

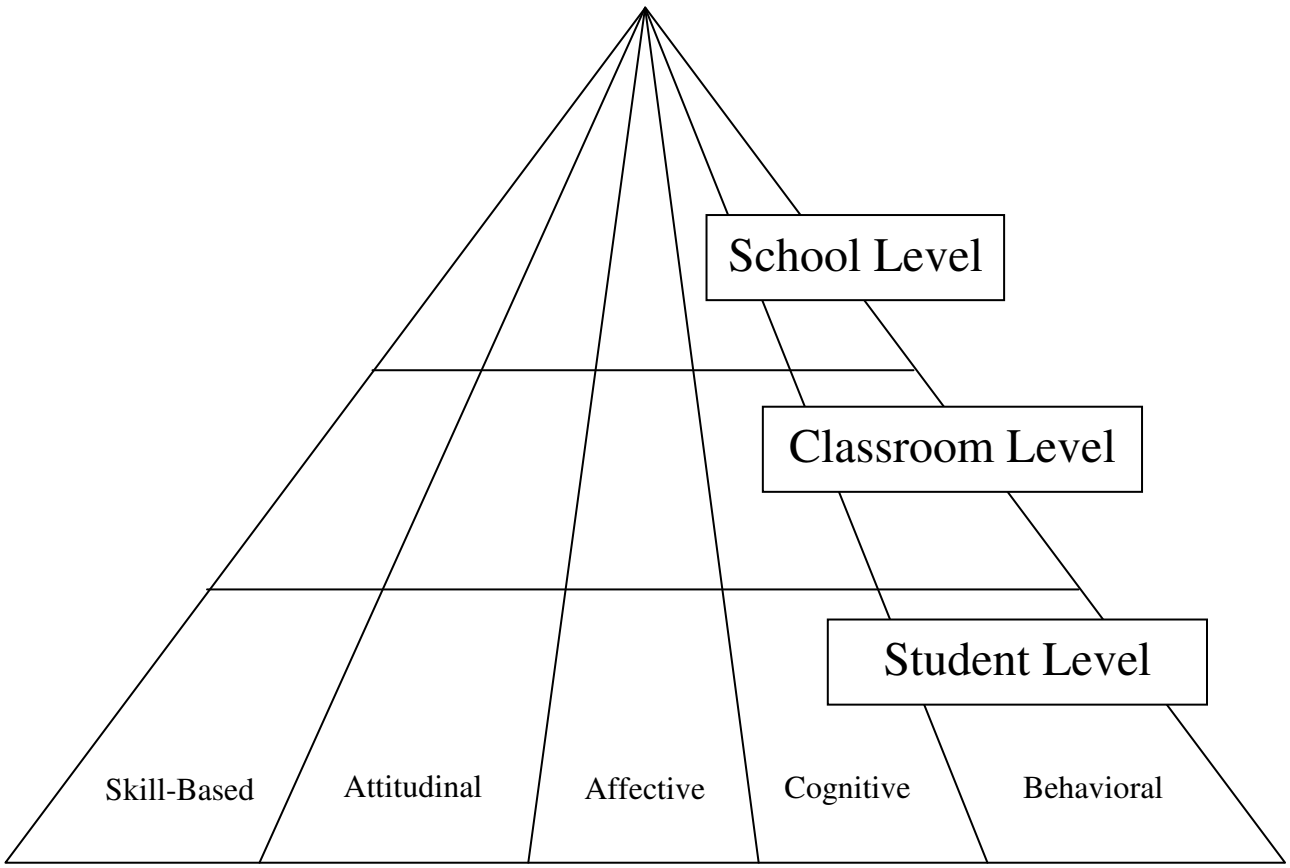

Figure 2. The multi-level multi-dimensional model

The authors believe that the proposed multi-level multi-dimensional model will be more empirically testable for interactions between the students, his/her teachers, relationships within the institution, and the society and economy than other approaches. Consequently, following our path the authors want to build up a more holistic understanding of the relationship between effectiveness of the entrepreneurship education program and developing technical leaders with strong skills and an entrepreneurial mindset. The authors hope the proposed model serves as a useful tool for understanding multi-level multi-dimensional structures of entrepreneurship education program, as well as provides a starting point for examining potential insights into the dynamic interplay between student-level variables and class-level variables.

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