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Authors(s)	Martin, Bruce; McNally, Jeffrey J.; Kay, Michael
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Examining the Formation of Human Capital in Entrepreneurship: A Meta-Analysis of Entrepreneurship Education Outcomes

ABSTRACT

Effective human capital formation through the medium of entrepreneurship education and training (EET) is of increasing concern for governments, as EET is growing rapidly across the world. Unfortunately, there is a lack of consistent evidence showing that EET helps to create more or better entrepreneurs. We undertake the first quantitative review of the literature and, in the context of human capital theory, find that there is indeed support for the value of EET. Based on 42 independent samples ($N = 16,657$), we find a significant relationship between EET and entrepreneurship-related human capital assets ($r_w = .217$) and entrepreneurship outcomes ($r_w = .159$). The relationship between EET and entrepreneurship outcomes is stronger for academic-focused EET interventions ($r_w = .238$) than for training-focused EET interventions ($r_w = .151$). We find evidence of heterogeneity in many of our correlations, and recommend that future studies examine potential moderators to more clearly delineate EET effect sizes. We also find a number of methodological weaknesses among the studies analyzed and that those studies with lower methodological rigor are overstating the effect of EET. Recommendations to improve the quality of future work in the field are provided.

1. INTRODUCTION

Entrepreneurship education and training (EET) is growing rapidly in universities and colleges throughout the world (Katz, 2003; Kuratko, 2005) and governments are supporting it directly and indirectly through funding major investments to would-be entrepreneurs and existing small businesses. This trend is fuelled by a recognition that entrepreneurship can play an

important (even critical) role in economic growth and employment (Schumpeter, 1934; Shane & Ventkataraman, 2000; Kuratko, 2005), and assertions that entrepreneurship education can play a vital role in developing more and/or more able entrepreneurs (e.g., Gorman, Hanlon, & King, 1997; Katz, 2007; Pittaway & Cope, 2007). Unfortunately, as several scholars have noted (e.g., Weaver, Dickson, & Solomon, 2006; Peterman & Kennedy, 2003), there is little consistent evidence to support these claims.

This study contributes to the entrepreneurship literature by providing the first meta-analytic review of extant EET studies linking EET-specific interventions with entrepreneurship outcomes. Our analysis is grounded in human capital theory (Becker, 1964; Mincer, 1958), as it is well suited to the examination of educational outcomes. The use of human capital theory to explain aspects of entrepreneurial success is also well established in the entrepreneurship literature (e.g. Pfeffer, 1994), but almost exclusively as a static model where accumulated education and experience is related to various forms of success (e.g. Chandler & Hanks, 1998; Rauch, Frese, & Utsch, 2005; Cassar, 2006; Dyke, Fischer, & Reuber, 1992; van der Sluis, van Praag, & Vijverberg, 2005). In their recent meta-analysis, Unger, Rauch, Frese and Rosenbusch (2011) make the case for why human capital theory must be considered in less static terms, at least as it relates to the field of entrepreneurship:

Given the dynamics in entrepreneurship and the constant need to learn and to adapt, it may prove useful to look beyond the static concept of human capital and to examine outcomes of actual learning activities... (p. 3)

Our work also addresses the need for a more dynamic depiction of human capital in the entrepreneurship field, by examining the outcomes of educational activities that are specific to entrepreneurship. This dynamic view of human capital for the entrepreneurship field examines the relationships between human capital *investments*, which are inputs, such as the time and

money spent taking a course in entrepreneurship; human capital *assets*, which represent the capability that may be garnered from the *investments*, such as knowledge and skills; and entrepreneurship *outcomes*, such as starting or growing a new business. The distinction that we are making between human capital *investments*, human capital *assets*, and entrepreneurship *outcomes* is important to note, because, although our terminology is in line with several researchers (e.g., Hitt, Bierman, Shimizu, & Kochhar, 2001; Lepak & Snell, 1999), there is little consistency in terminology in the literature generally (cf. Reuber & Fischer, 1999; Unger et al., 2011). Investigating a more dynamic approach to human capital in the context of the potential impact of entrepreneurship education and training requires a clear delineation of these three terms.

Our work also contributes to a growing body of evidence that human capital assets specific to entrepreneurship have a stronger link to positive new venture performance than more general human capital assets (Unger et al., 2011). We take this specificity further to elucidate the differences between two main types of EET—training-focused educational interventions and academic-focused educational interventions—which we posit will influence outcomes differentially.

Finally, we provide recommendations to future researchers in this field regarding specific methods that should be used in order to improve the quality and the utility of the information generated. This is consistent with concerns raised by several scholars regarding the quality of research conducted in the entrepreneurship education field (e.g. Bécharde & Grégoire, 2005; Kailer, 2005; Weaver et al., 2006).

2. LITERATURE REVIEW AND HYPOTHESES

2.1 Entrepreneurship Education Research

Several recent narrative reviews of the entrepreneurship education literature (e.g., Kuratko, 2005; Pittaway & Cope, 2007; Weaver et al., 2006) have noted that there may be important positive links between EET and a variety of entrepreneurship-related human capital assets and entrepreneurship outcomes. For example, it has been reported that individuals who have taken university-level courses in entrepreneurship have higher intentions to start a business (Galloway & Brown, 2002) than those who have not taken entrepreneurship courses. Some research further suggests that individuals who have had entrepreneurship training and education are also more likely to start a business (e.g. Kolvereid & Moen, 1997) than those who have not had entrepreneurship education and training. They may also be more successful in opportunity identification tasks than those who have not received entrepreneurship education or training (DeTienne & Chandler, 2004).

There is also research showing that EET may sometimes be negatively associated with the above-mentioned outcomes. For example, Oosterbeek et al. (2010) measured entrepreneurial intentions among undergraduate university students before and after they completed an entrepreneurship course. They found that students actually had lower levels of intentions to start a business after completing the course. Similarly, Mentoor and Friedrich (2007) studied the impact of an undergraduate course in business that focuses on entrepreneurship and small business management, and found negative correlations with a number of entrepreneurship-related human capital assets. More distally, it has also been shown that training entrepreneurs in business planning, which is often a key aspect of entrepreneurship education and training programs, can be negatively related to entrepreneurial performance (Honig & Karlsson, 2004; Honig & Samuelsson, 2008).

Entrepreneurship researchers, educators and practitioners are thus left with a dilemma regarding how the conflicting findings of the outcomes of EET should be interpreted. One interpretation, using the statistical significance “vote count” method employed by several recent narrative reviews (e.g., Kuratko, 2005), is that there is indeed a significant positive relationship between entrepreneurship education and a variety of outcomes. However, this assumption has yet to be examined quantitatively. This is problematic, because there is sufficient reason to question the findings of narrative reviews (Guzzo, Jackson, & Katzell, 1987). These types of reviews do not take into account the distorting effects of sampling error, measurement error, and other artifacts that might lead to a particular conclusion in the face of conflicting findings (Hunter & Schmidt, 1990; 2004). These contradictory findings are difficult to incorporate into narrative reviews (Hunter & Schmidt, 2004), and thus a meta-analysis may be helpful to better interpret the literature.

2.2 Theoretical Grounding: Human Capital Theory

Until recently the literature on EET has generally lacked linkage to established theories that would explain the relationship between education and entrepreneurial behavior (Henry, Hill, & Leitch, 2003; Kailer, 2005). There has, however, been a recent move to improve the theoretical grounding of EET findings. One theory that shows promise for understanding the impact of EET is human capital theory (Becker, 1964; Mincer, 1958). Human capital theory predicts that individuals or groups who possess greater levels of knowledge, skills, and other competencies will achieve greater performance outcomes than those who possess lower levels (Ployhart & Moliterno, 2011). Common measures of human capital include level of education, work experience, upbringing by entrepreneurial parents, and other life experiences.

Entrepreneurship researchers have studied the relationship between human capital and entrepreneurship outcomes at the individual (e.g. Cassar, 2006), group (e.g. Zarutskie, 2010) and venture (e.g. Colombo & Grilli, 2005) levels of analysis. Also, a long line of research has considered the differential impact between general human capital and task-related or specific human capital (e.g. Becker, 1964; Gimeno, Folta, Cooper, & Woo, 1997; Zarutskie, 2010), with Unger et al.'s (2011) recent meta-analysis showing a significantly stronger relationship between task-related human capital and entrepreneurial performance ($r_c = .109$) than for general human capital ($r_c = .069$), although both correlations are considered small.

Further literature has acknowledged the importance of distinguishing between human capital investments and what we refer to as human capital assets. This may be an advance on the more traditional “static” view of human capital measured as a fixed set of knowledge, skills and experiences which currently appears in the scholarly literature (e.g. Reuber & Fischer, 1999; Davidsson & Honig, 2003). In distinguishing between human capital investments and human capital assets, Unger et al. (2011) recognize that assets do not derive automatically or uniformly from investments. Individuals of different innate capacities may experience the same investment, but extract different assets. Further, Sonnentag (1998) showed that experience may or may not lead to increased knowledge. Here again Unger et al.'s (2011) meta-analysis provides evidence for the incremental value of measuring the relationship between human capital assets and entrepreneurial success ($r_c = .20$) versus human capital investments and entrepreneurial success ($r_c = .09$). These findings and this general line of inquiry informs our own findings and the development of a dynamic view of human capital formation in the entrepreneurship field.

2.2.1. Linking EET and Human Capital Theory. At first glance, the link between human capital theory and EET might seem relatively obvious. For example, a variety of researchers

(Unger et al., 2011) have demonstrated the positive relationship between education and success as an entrepreneur. However, it is not clear that education in entrepreneurship is specifically associated with increases in entrepreneurship-related human capital assets or entrepreneurship outcomes. Following Becker's (1964) learning perspective of human capital, we examine the EET literature with the aim of quantifying the relationship between EET and entrepreneurship-related human capital assets and between EET and entrepreneurship outcomes.

Our review of the extant EET literature has identified 79 studies that have investigated the effectiveness of entrepreneurship education and training in increasing entrepreneurship-related human capital assets and/or entrepreneurship outcomes. Although there is still disagreement among authors as to which are the most appropriate variables to measure, and the most appropriate research methods to ensure meaningful, generalizable results, most of the research supports positive links between EET and three broad types of entrepreneurship-related human capital assets. First is the relationship between EET and entrepreneurial knowledge and skills (e.g. Fayolle, Lassas-Clerc & Tounes, 2009; DeTienne & Chandler, 2004; Hanke, Warren, & Kisenwether, 2010). The second relationship is between EET and positive perceptions of entrepreneurship (e.g. Peterman & Kennedy, 2003; Souitaris et al., 2007; Cooper & Lucas, 2007; Zhao, Siebert, & Hills, 2005). The third relationship is between EET and intentions to start a business (e.g. Athayde, 2009).

Although most studies examining EET and each of the three broad types of entrepreneurship-related human capital assets indicate positive relationships, some have shown statistically nonexistent or even negative relationships. For example, Oosterbeek et al. (2010) found a negative relationship between EET and knowledge and skills, self-efficacy, and entrepreneurial intentions among undergraduate university students in the Netherlands. It is of

note that this is among the more methodologically rigorous studies in this literature, incorporating both treatment and control samples, with pre- and post-intervention responses, and an approximation of a randomized sample. The “treatment group” was required to take an entrepreneurship course, as a new addition to the general business program in one campus, whereas the “control group” students were not given the option of taking the course at their campus. As most of the studies we have reviewed in this literature evaluate entrepreneurship courses that are electives, the work of Oosterbeek and colleagues may not represent a generalizable indication of the potential for increased entrepreneurial intentions among those who willingly choose to take entrepreneurship courses or programs. It does, however, provide some insight into the impact of EET on something close to a random sample of both treatment and control participants. Hanke et al. (2010) found a mix of positive and negative relationships between EET and a variety of human capital variables, while studying two different EET interventions among university students in the United States, with both interventions relating negatively to desirability. Mentoor & Friedrich (2007) reported negative relationships between EET and both knowledge and skills, and attitudes towards entrepreneurship among undergraduate university students in South Africa, and von Graevenitz et al. (2010) found a small negative relationship between EET and intentions toward entrepreneurship among German undergraduate students. Three separate studies (Fayolle, Gailly & Lassas-Clerc, 2006a; Fayolle & Gailly, 2009; Garalis & Strazdiene, 2007) found essentially no relationship between EET and knowledge and skills, attitudes, or intentions towards entrepreneurship, among samples of undergraduate and graduate students in France and Lithuania.

Overall, the independent samples that show negative, nonexistent or mixed relationships between EET and entrepreneurship-related human capital assets are more than offset by the

numerous independent samples that show positive relationships between these same variables. Further, given that human capital theory predicts that education will relate positively to human capital assets, we develop the following hypotheses.

H1: EET will be positively associated with entrepreneurship-related human capital assets.

Several narrative reviews of the entrepreneurship education literature have noted that there may be important links between EET and entrepreneurship outcomes (e.g., Kuratko, 2005; Pittaway & Cope, 2007; Weaver et al., 2006). More recently, the relationship between general human capital investments (as opposed to entrepreneurship-specific investments) and entrepreneurship outcomes was found by Unger et al. (2011) to be positive. Given this, we expect EET as a whole to follow the same pattern. However, it is important to note that “success” in the EET literature - a literature that for good reason employs essentially all student samples - is often measured by less distal outcomes than new venture success. Thus the evidence of recorded entrepreneurial behavior includes nascent behaviors (e.g., Charney & Libecap, 2000), start-up behaviors (e.g., Menzies & Paradi, 2002); as well as financial success (e.g., Cruz, Escudero, Barahona, & Leitao, 2009).

H2: EET will be positively associated with entrepreneurship outcomes.

Our review of the literature shows that the type of EET can range from a relatively short training course that focuses on core entrepreneurship knowledge and skills related to starting a

particular business in a particular jurisdiction (e.g. Miron & McClelland, 1979), to full academic courses that provide a broad theoretical and conceptual understanding of topics, such as how opportunities are identified, decision making in highly ambiguous contexts, and causation and effectuation (e.g. De Tienne & Chandler, 2004; Lee, Chang, Lim, 2005). To understand how these two EET types might impact the relationship between EET and entrepreneurship-related human capital assets, and entrepreneurship outcomes, we consider findings from the field of educational psychology related to the transfer of learning (Thorndike & Woodworth, 1901). Educational psychologists have shown that variations in the degree of transfer of educational content to application can be attributed in part to the *near-far distinction* (Haskell, 2001; Barnett & Ceci, 2002), which refers to the degree of similarity between learning and application context and content domains. Near transfer refers to application contexts that are similar to the learning contexts, whereas far transfer refers to dissimilar contexts. Learning transfer is more easily achieved in near contexts (Haskell, 2001; Benander & Lightner, 2005; Kneppers, Elshout-Mohr, Boxtel, van Hout-Wolters, 2007).

Applying the near-far distinction to EET, we expect that both types of EET should transfer to entrepreneurship-related human capital assets and entrepreneurship outcomes to some extent, as both represent relatively near transfer contexts. However, training-focused EET might be expected to have a stronger relationship to entrepreneurship-related human capital assets than academic-focused EET, as the emphasis on core knowledge and skills related to starting a particular business will more easily transfer to the ability to recall and exhibit entrepreneurial knowledge and skills, for instance. Conversely, academic-focused EET is likely to transfer better to such entrepreneurship outcomes as financial success and the duration of maintaining a business than training-focused EET, as these contexts require decision making in highly

ambiguous and dynamic conditions. Further, the content required to deal with them is more “near” to the broad conceptual and theoretical learning in academic-focused educational settings than training-focused EET. Thus, we hypothesize the following:

H3a: Training-focused EET will be more positively associated with entrepreneurship-related human capital assets than will academic-focused EET.

H3b: Academic-focused EET will be more positively associated with entrepreneurship outcomes than will training-focused EET.

3. METHODS

3.1. The Search for Primary Data

We searched for articles and manuscripts in six ways. First, we searched the electronic databases in the areas of general business and management education, including ABI/Inform Global Business Index, Business Source Complete, Education Full Text, ERIC (Education), PsycINFO, Google Scholar, JSTOR and Scholars Portal, among others. Second, we checked all of the references that might be related to our work in previous reviews of the outcomes of entrepreneurship education and training. Third, we posted messages requesting both published and unpublished manuscripts on a variety of electronic listservs. Fourth, we wrote a number of researchers known for their work in the area of entrepreneurship education to assemble a list of possible unpublished manuscripts, technical reports, and other articles that were available. Fifth, we contacted associations of educational institutions involved in EET in North America (e.g. National Association for Community Colleges Entrepreneurship (USA), Canadian Association of Community Colleges), to request technical reports from them and, where possible, directly from

their members. Sixth, we contacted national government bureaus involved with employment data in North America (e.g. Bureau of Labor Statistics (USA), Industry Canada) to obtain any technical reports related to government-funded self-employment/entrepreneurship training programs.

It is likely that there exist more technical reports from educational institutions than we were able to find. Early attempts to contact institutions directly without an established contact proved unsuccessful. However, our extensive use of listservs both in academia and among the college and entrepreneurship education associations should have provided reasonable coverage of this group.

3.2 Decision Rules for Inclusion of Studies in Meta-Analysis

To be included in the meta-analysis, studies had to meet several criteria. First, the predictor variable of each study had to have been either entrepreneurship education (e.g., a university course or program of study) or training. Second, the criterion variables had to be one of two broad types. The first type was entrepreneurship-related human capital assets, including: 1) knowledge and skills, which was comprised of knowledge of entrepreneurship and entrepreneurial process (e.g. Fayolle, Lassas-Clerc & Tounes, 2009), competency in identifying innovative business opportunities (e.g. DeTienne & Chandler, 2004) and competency in dealing with ambiguity in decision making (e.g. Hanke et al. 2010); 2) positive perceptions of entrepreneurship, which was comprised of attitudes towards entrepreneurship (e.g. Souitaris et al., 2007), desirability of becoming an entrepreneur (e.g. Cooper & Lucas, 2007), feasibility of becoming an entrepreneur (e.g. Peterman & Kennedy, 2003), and self-efficacy related to entrepreneurship (e.g. Zhao, Siebert, & Hills, 2005) ; and 3) intentions to start a business (e.g. Athayde, 2009). The second type was entrepreneurship outcomes, including: 1) nascent

behaviours, such as writing a business plan and seeking funding (e.g. Souitaris et al., 2007); 2) start-up (e.g. Kolvereid & Moen, 1997); and 3) entrepreneurship performance, which was comprised of financial success (e.g. Karlan & Valdivia, 2006), duration of running a business (e.g. Chrisman & McMullan, 2004), and personal income from owned business (e.g. Charney & Liebcap, 2000). The third criterion required that studies report data that could be included in a meta-analysis (i.e., r values or data that could be transformed into r values, such as d , t , F , etc.) by making comparisons either pre- and post-EET intervention, or via treatment and control groups. We coded for moderators, such as age, gender, and type of educational intervention, but, aside from EET type we found too few studies to allow for moderator analysis. Applying these criteria to our initial list of 79 studies yielded a final total of 42 independent samples that represent 16,657 students (see Table 1). That is, we excluded 37 studies because they did not meet one or more of the above-listed criteria. Twenty-one studies were eliminated because they did not incorporate pre-post or treatment-control comparisons. A further 13 studies were excluded because they did not report the data required for creating an r value, and we were unable to obtain this information from the authors. A final three studies were eliminated because, although they met our inclusion criteria, upon further examination they used samples that were duplicated in our overall list of studies.

Insert Table 1 about here

3.3 Computation and Analysis of Effect Size

Two measures of effect size are currently popular in the meta-analysis literature; d and r (Jackson, Hunter, & Hodge, 1995; Hunter & Schmidt, 2004). The d statistic is the difference between two means divided by the within-group standard deviation. The r statistic is

the correlation between the predictor and criterion variables in the total sample pooled across groups. Because the r statistic works equally well whether two or more levels of predictor variables are defined, we chose weighted r as the primary measure of effect size. When required, we converted statistics to an r statistic using the Wilson (2001) effect size determination program, recommended by Lipsey and Wilson (2001).

We meta-analyzed the sample-size-weighted correlation coefficients from the studies in the reference list noted with an asterisk. That is, we recorded the observed r rather than the r corrected for research artifacts. We then weighted the observed estimates as noted below and analyzed our data with the Schmidt and Le (2004) meta-analysis program.

3.4 Variable Coding

The authors coded each of the 42 independent samples identified on 25 items, which were grouped into five categories: a) entrepreneurship-related human capital assets; b) entrepreneurship outcomes; c) moderators; d) methodology; and e) publication bias (see Table 2). Entrepreneurship-related human capital assets contained three components: 1) knowledge and skills (including knowledge of entrepreneurship and entrepreneurial process, competency in identifying innovative business opportunities, competency in dealing with ambiguity in decision making); 2) positive perceptions of entrepreneurship (including attitudes towards entrepreneurship, desirability of becoming an entrepreneur, feasibility of becoming an entrepreneur, and self-efficacy for entrepreneurship); and 3) intentions to become an entrepreneur. Entrepreneurship outcomes contained three components: 1) nascent behaviour, 2) start-up, and 3) entrepreneurship performance (including success in terms of duration, success in terms of financial performance, and personal income from owned business). Where studies

reported two or more correlations in one category, the correlations were averaged (Hunter & Schmidt, 1990).

We calculated interrater agreement as a percentage, consistent with other meta-analyses (e.g. Barrick & Mount, 1991) and found overall interrater agreement was 84%, with predictor agreement of 100% and criterion agreement of 78%. By category, interrater agreement was 76% for entrepreneurship-related human capital assets, 82% for entrepreneurship outcomes, 95% for the course-type moderator, 89% for the methods variables, and 100% for the publication variable. Disagreements were resolved by discussion until full consensus was reached.

Insert Table 2 about here

4. RESULTS

4.1 Analyses

Our analysis was based upon the procedures first developed by Hunter and Schmidt (1990). We calculated effect sizes in a “bare-bones” manner that corrected for sampling error, but not for other artifacts (Hunter & Schmidt, 2004). Sampling error, which occurs when data are collected from a non-representative sample, is inversely related to sample size and, if not properly controlled, can dramatically impact the outcomes of a meta-analysis. In fact, sampling error alone has been found to account for the bulk of artifactual variance in most studies (i.e., more than 90% for small or medium samples and more than 70% for large samples, e.g., $N = 500$) (Koslowsky & Sagie, 1994). Other artifacts that can alter the value of outcomes in research include error of measurement in both the independent and dependent variable, dichotomization of a continuous variable, and range restriction, among others. We did not correct for these study

artifacts because information about them was not available either from the primary studies or via the requests to the studies' authors.

To test hypotheses 1 and 2, it was necessary to determine whether our obtained effect sizes differed significantly from zero. To that end we computed a 95% confidence interval around the estimated population correlation. When the lower boundary of the confidence interval was greater than zero, effects were deemed to be significant (Judge, Heller, & Mount, 2002).

To test the moderation posited in hypotheses 3a and 3b, we examined homogeneity by applying Hunter and Schmidt's (1990, 2004) "75% rule." This rule states that effects might be considered homogenous if more than 75% of the variance of the observed effects is explained by sampling error variance. To assess the statistical significance of the difference between each of our moderator pairs we calculated z-scores.

4.2 Meta-Analytic Results

Results for each of the three hypotheses are summarized in Table 3.

Insert Table 3 about here

Our results indicated a weighted correlation of .217 ($K = 33$, $N = 11,125$) between EET and total entrepreneurship-related human capital assets. It is of note that two studies in our analyses of entrepreneurship-related human capital assets had very large sample sizes (i.e., Gine & Mansuri, 2009; Karlan & Valdivia, 2008). Because these large samples may have inflated our results, we ran the analysis without the large samples. These results indicated a weighted correlation of .184 ($K = 31$, $N = 6,233$) between EET and total entrepreneurship-related human capital assets. The weighted correlations of these two sets of calculations did not differ significantly ($z = 0.668$, ns), indicating that the large samples did not influence the results. Thus,

Hypothesis 1 was supported. We also examined the three main sub-groups of entrepreneurship-related human capital assets and found a weighted correlation between EET and entrepreneurship-related knowledge and skills of .237 ($K = 17$, $N = 8,334$), between EET and positive perceptions of entrepreneurship of .109 ($K = 18$, $N = 3,828$), and between EET and intentions to become an entrepreneur of .137 ($K = 19$, $N = 3,314$).

Regarding entrepreneurship outcome variables, our results indicated a weighted correlation of .159 ($K = 13$, $N = 10,524$) between EET and entrepreneurship outcomes overall. We also ran the analysis without the large samples associated with three large studies (Gine & Mansuri, 2009; Karlan & Valdivia, 2008; Michaelides & Benus, 2010). Those results indicated a weighted correlation of .207 ($K = 10$, $N = 2,806$) between EET and entrepreneurship outcomes. The weighted correlations of these two sets of calculations did not differ significantly ($z = -1.550$, ns), indicating that the large samples did not influence the results. Thus, Hypothesis 2 was supported. We also examined two main sub-groups of entrepreneurship outcomes and found a weighted correlation of .124 ($K = 6$, $N = 6,706$) between EET and start-up, and a weighted correlation of .166 ($K = 9$, $N = 5,790$) between EET and entrepreneurship performance.

Our moderation analysis results show a weighted correlation of .246 ($K = 12$, $N = 6,819$) between training-focused EET interventions and entrepreneurship-related human capital assets. We also ran this analysis without the large samples associated with two large studies in this group (Gine & Mansuri, 2009; Karlan & Valdivia, 2008). Those results indicated a weighted correlation of .210 ($K = 10$, $N = 1,927$) between training-focused EET interventions and entrepreneurship-related human capital assets. A comparison of the two sets of training-focused studies (i.e., those that included the large samples and those that did not) indicated that the correlations did not differ significantly ($z = 0.324$, ns). The weighted correlation between

academic-focused EET interventions and entrepreneurship-related human capital assets was .180 ($K = 21, N = 4,306$). A comparison of the results for the training-focused EET studies and the academic-focused EET studies showed that the weighted r for training-focused EET was not significantly higher in magnitude than for academic-focused EET ($z = 1.056, ns$). Similarly, when the smaller set of training-focused EET studies (excluding the two large samples), was compared with the academic-focused EET studies, the weighted r for training-focused EET was not significantly higher in magnitude than for academic-focused EET ($z = 0.290, ns$). Thus, Hypothesis 3a was not supported.

Our results indicated a weighted correlation of .151 ($K = 9, N = 9,353$) between training-focused EET and entrepreneurship outcomes, whereas the weighted correlation between academic-focused EET and entrepreneurship outcomes was .238 ($K = 4, N = 1,795$). This moderator effect was significant ($z = -2.600, p < .01$). We also ran the analysis without the large samples associated with three studies in this group (Gine & Mansuri, 2009; Karlan & Valdivia, 2008; Michaelides & Benus, 2010). Those results indicated a weighted correlation of .152 ($K = 6, N = 1,011$) between training-focused EET and entrepreneurship outcomes. This moderator effect was also significant ($z = -4.395, p < .001$). A comparison of the two weighted correlations for training-focused EET (i.e., those that included the large samples and those that did not) indicated that the correlations did not differ significantly ($z = -0.026, ns$). Thus, Hypothesis 3b was supported.

Finally, we conducted three sets of analyses to determine whether 1) publication bias, 2) study rigor, and 3) sampling bias may have impacted our results. To examine the potential for publication bias, we compared overall results of all published studies ($r_w = .188, K = 29, N =$

5,729) to unpublished studies ($r_w = .178$, $K = 13$, $N = 10,928$). We found that publication bias did not significantly impact our results ($z = 0.196$, *ns*).

To evaluate study rigor, we compared studies that incorporated both pre- and post-measures of participant responses and comparisons of treatment and control groups, with those studies that incorporated only one or the other (inclusion criteria for the meta-analysis required at least one such comparison). We established this rigor threshold based on Cook and Campbell's (1979) assertion that, as a base, studies that do not contain treatment and control group comparisons and pre- and post-measures are designs “that often do not permit reasonable causal inferences” (p. 95). Our results indicated a weighted correlation between EET and overall results of .142 ($K = 11$, $N = 10,233$) for rigorous studies, whereas the weighted correlation for those studies that did not meet our rigor criterion was .246 ($K = 31$, $N = 6,424$), and this moderator effect was significant ($z = 1.990$, $p < .05$). We further examined study rigor to determine whether there might be a trend to increased rigor over time. To do so we ran a bivariate correlation analysis of the study rigor variable. We coded all studies that were found to be below our rigor threshold as “1” and all those there were above the threshold as “2”. We coded our time variable using the year the study was published or produced. We found that study rigor was not significantly related to the time variable ($r = .213$, *ns*).

Finally, we examined how sampling bias may have impacted our results by comparing studies that included random assignment to treatment and control groups ($r_w = .156$, $K = 6$, $N = 9,056$) with those that did not include random assignment ($r_w = .212$, $K = 36$, $N = 7,601$), and found that random assignment did not have a significant impact on the results ($z = 0.909$, *ns*).

5. DISCUSSION

5.1. Contributions

Although EET programs are growing rapidly around the world, extant qualitative reviews have been equivocal about their impact on entrepreneurship-related human capital assets and entrepreneurship outcomes (e.g. Weaver et al., 2006). This is due in part to the fact that, although most studies report positive relationships, a number of important studies have shown negative results for EET on entrepreneurship-related human capital assets and entrepreneurship outcomes. Thus, it is not clear what impact EET might be having on its students. At the same time recent entrepreneurship literature has highlighted the need to better understand the dynamic nature of human capital development in the highly dynamic entrepreneurship field (Unger et al., 2011).

Our study addresses these gaps in the entrepreneurship literature in an important way. We have provided a quantitative assessment of the EET literature showing that EET has positive, significant relationships with a number of entrepreneurship-related human capital assets and entrepreneurship outcomes. This builds on previous work, such as that of Unger et al. (2011) to show the specific impact of entrepreneurship education and training on human capital development and entrepreneurship development.

Overall, our results provided full support for the first two hypotheses associated with this study and partial support for the third hypothesis. Evidence in support of Hypothesis 1 demonstrated that EET is associated with higher levels of (a) total entrepreneurship-related human capital assets, (b) entrepreneurship-related knowledge and skills, (c) positive perceptions of entrepreneurship, and d) intentions to become an entrepreneur (see Table 3). To the best of our knowledge, this is the first time that the transfer of entrepreneurship-related human capital

investments to entrepreneurship-related human capital assets in the field of entrepreneurship has been demonstrated via meta-analytic examination.

Evidence in support of Hypothesis 2 showed that EET was positively associated with (a) entrepreneurship outcomes in general (b) start-up, and (c) entrepreneurship performance (see Table 3). Again, to our knowledge this is the first time this link has been demonstrated in a quantitative review of the extant entrepreneurship literature. We believe these findings provide some empirical indication that EET is positively related to important benefits in a number of areas.

Evidence showing partial support for our third hypothesis indicates that the focus of EET interventions does moderate the relationship between EET and entrepreneurship outcomes, but not the relationship between EET and entrepreneurship-related human capital assets. Specifically, academic-focused EET was found to have a significantly stronger relationship with entrepreneurship outcomes than training-focused EET, as we hypothesized, but training-focused EET was not found to have a significantly stronger relationship with entrepreneurship-related human capital assets than academic-focused EET, contrary to our hypothesis (see Table 3).

Borrowing from the field of educational psychology, and in particular transfer of learning perspective (Thorndike & Woodworth, 1901), we argued that the near-far distinction (Haskell, 2001, Barnett & Ceci, 2002) applied to the two broad types of EET and the differing content and contexts that were required to develop entrepreneurship-related human capital assets and entrepreneurship outcomes. Specifically, we expected that training-focused EET would be more likely to allow students to demonstrate the core entrepreneurship knowledge and skills required to start a particular business in a particular setting, because the learning and application context and content are more “near” than with academic-focused EET. This aspect of our argument was

not supported, and although the reported correlations follow the directions that we expected, the lack of significance in the differences is difficult to interpret without further study. Future research that more specifically examines the development of entrepreneurship-related human capital assets in both training-focused and academic-focused EET is needed to help bring clarity to this issue. However, support for the moderation of EET to entrepreneurship outcomes relationship is encouraging. It suggests that academic-focused EET, with its broader conceptual and theoretical content may be more likely to allow students to make decisions in the highly ambiguous and dynamic contexts that are required to achieve financial success and maintain a business over an extended period of time.

We found indications of homogeneity in the correlations for academic-focused EET and for training-focused EET, suggesting that there are unlikely to be moderators significantly affecting the results. This was not the case for all of our other analyses, where we found strong indications of heterogeneity in our correlations, suggesting that there are moderators, which might help to better explain the relationships. Future research should explore these moderators.

Our findings related to study rigor help to quantify a concern that has been raised by scholars, such as Weaver et al. (2006), that the EET literature suffers from low quality studies. We have noted that a large number of studies were not viable for inclusion in our meta-analysis because of methodological and/or reporting issues, and that among the 42 studies that were viable for inclusion, 31 did not meet a high standard of methodological rigor (incorporating both pre- and post-measures of participant responses and comparisons of treatment and control groups; see Table 1). Although there is a directional indication toward increased methodological rigor, newer studies are not significantly more rigorous than older studies. We go further, however, to show that studies that do not meet our criterion for high rigor report stronger

relationships than those that do meet the rigor criterion (see Table 3). In other words, our results suggest that poorer quality studies tend to overestimate the impact of EET. We hope that by demonstrating this exaggerating influence of low methodological rigor on the impact of EET we will help to encourage future researchers to conduct more rigorous studies.

Our results suggest that the effect sizes of EET are small using Cohen's (1992) guidelines for categorizing effect sizes. We compared these results to those found in meta-analyses examining management training in general (e.g., Burke & Day, 1986; Morrow, Jarrett, & Rupinski, 1997; Collins & Holton, 2004), which showed medium effect sizes. Reasons for the weaker performance of EET are difficult to determine. It may be unrealistic to expect outcomes of university courses, many of which may be designed to introduce students to the subject of entrepreneurship for the first time, to compare favorably with outcomes of management training courses, many of which are designed and sponsored by companies to improve their current managers' performance. However, this does not account for the relative low effect sizes that we found among the training-focused courses that were examined by studies in our analysis (see Table 3). It may be that, when comparing behavioral outcomes, the broad set of knowledge, skills and competencies that one must put into practice in order to become a successful entrepreneur is of a much greater magnitude than the more specific sets of skills that are required of a manager to demonstrate transfer of learning from a particular training course to a current management position. Yet this does not account for the relative low effect sizes we found for knowledge and skills specifically (see Table 3), which are most comparable to the learning outcomes often studied in management training (cf. Burke & Day, 1986). It may be that EET is simply not developed enough at this point. Further studies that examine the impact of course design and teaching methods may help to explain these relative weak effect sizes, and, by

identifying important moderators, show that certain types of EET garner larger effect sizes. Such learning, if incorporated into future EET interventions may lead to improvements that will make EET more effective generally.

5.2. Potential Limitations

Contributions aside, this paper is subject to at least three potential limitations. First, our meta-analysis included a variety of studies that ranged from low to high methodological rigor. Meta-analyses are sometimes criticized for mixing good and bad studies (Rosenthal & DiMatteo, 2001). This criticism, known as the “garbage in and garbage out” issue (Hunt, 1997: 42), is relevant to this study. For example, as can be seen in Table 1, some studies did not include a design that compared a treatment group, whose members received entrepreneurship education or training, with a control group, whose members did not receive entrepreneurship education or training (e.g., Tam & Hansen, 2009; von Graevenitz, Harhoff, & Weber, 2010). Some designs did not include measures of variables at both pre- and post-education times (e.g., Charney & Libecap, 2000; Lee et al., 2005). Although we decided to include these studies, because they represent much of the literature in this field and do provide some indication of EET outcomes, we acknowledge that the validity of our results would be stronger if all analyzed studies were conducted with a high standard of methodological rigor. Importantly, our study helps to quantify the impact that study rigor is having on research results, showing that lower rigor studies may be overestimating the impact of EET.

Second, all but six of the studies we analyzed did not involve randomized assignment to treatment and control groups, which raises a concern for sampling bias. It is possible that those who have not chosen to take an EET course may demonstrate much weaker and possibly negative results in terms of entrepreneurship-related human capital assets and entrepreneurship

outcomes. This was the case with participants in the Oosterbeek et al. (2010) study, which was one of only six studies that we categorized as random assignment. However, when we meta-analyzed all six studies that included randomized assignment we found that results were still positive ($r = .156$) and not significantly lower than those studies that did not employ randomization ($r = .212$; $z = 0.909$, ns). This suggests that sampling bias did not have a significant impact on the results.

A third potential limitation is that our meta-analysis corrected only for sampling error. This is because we could not find information relating to other artifacts (e.g., range restriction, reliability estimates, etc.) for the majority of the studies we identified as having the potential to be included in our meta-analysis. As such, we were left with making a judgment call on their excludability. These types of judgment calls are common in the majority of meta-analytic research (Guzzo et al., 1987), and our study is no exception. The exact magnitude of the relationships remains to be confirmed once a broader sample of methodologically rigorous studies is available. Moreover, this limitation to our study is ameliorated by research that has found the majority of artifactual variance to be due to sampling error alone (Koslowsky & Sagie, 1994).

5.3. Future Research

Although our findings did not show a statistically significant improvement in study rigor over time, we did find evidence of a positive directional relationship. Further, the fact that all of the 11 studies that met our rigor criterion were produced since 2003 (see Table 1) provides some reason for optimism that the quality of EET research is improving. Nevertheless, many recent studies have been produced that do not meet a high standard of methodological rigor. In order to improve the literature so that future meta-analyses can provide even more valuable findings for

academics and practitioners, EET researchers must include pre- and post- EET interventions (ideally at several points in time post-intervention), and should include treatment and control groups. Souitaris et al. (2007) is an example of a good quasi-experimental design with both pre- and post-intervention surveying and use of treatment and control groups. Where possible, random assignment to treatment and control groups should be carried out, although this is often difficult to implement for both practical and ethical reasons. Oosterbeek et al. (2010) show how it may be possible to reflect random assignment in certain circumstances if researchers are alert to opportunities. In this case, Oosterbeek and his colleagues identified that the creation of a required course in entrepreneurship for a business program at one campus of a school and lack of any similar course offering at another campus of the same school created an opportunity to examine the outcomes of the new entrepreneurship course in a manner that is very close to that of a randomized experiment. Although the participants were not truly randomized, the authors confirmed through extensive post hoc analysis that the only notable difference between the two groups was their physical proximity to each campus.

In terms of data reporting, researchers should include correlation tables and estimates of reliabilities. Also, at a minimum, researchers should report the correlations amongst all study variables in a manner that is consistent with data reporting in other fields of management research (e.g., providing a zero-order correlation matrix). Such reporting improvements will greatly increase the ability of future researchers to make accurate claims about the effect sizes of EET on its outcomes. It will also increase the ease of conducting future meta-analytic reviews of the EET literature.

In terms of potential moderators, where possible, future research should include measures of age, education level, academic institution, academic program, course type (e.g., required

versus elective), ethnicity, nationality, gender, previous entrepreneurship experience, previous employment experience, and participants' perception of course goal, level, and content. We also recommend obtaining and reporting the main elements of the course syllabus, so that future research can control for the potential impact of course content and structure. This type of information might provide valuable insight into whether such things as course content (e.g. lecture material, guest speakers, online resources, modes of delivery, etc.), and course goals (e.g., learning introductory concepts and theory compared to learning specific skills) influence the outcomes of EET interventions. Examining different methods of employing experiential exercises, such as use of online venture creation simulations versus actual venture creation projects may also help explain variation in EET outcomes. Other examples of the types of moderation elements that may be fruitful to examine can be found in several studies included in this meta-analysis. Hanke et al. (2010) compared two undergraduate university entrepreneurship courses; a new course that employed problem based learning with a more traditional lecture-style course. Cooper and Lucas (2007) compared two training programs that incorporated different levels of interactive and experiential learning. The literature would benefit greatly from more examination of this type of course content variation, especially in studies that employ full quasi-experimental methods and examine both entrepreneurship-related human capital assets as well as entrepreneurship outcomes.

Future research might also examine differences in course instructors, such as the skill and/or background of course instructors (e.g. experienced entrepreneur versus academic), or teaching methods employed. For instance it may be that instructors who do not engage their students via class discussion or fair procedures, for example, are less motivating than instructors who are perceived to be more engaging or fair, even if the same course materials are used in both

cases. Future meta-analyses of EET outcomes would provide greater insight if these types of moderator variables were examined and reported in all new studies.

5.4 Concluding Remarks

We have provided what we believe to be the first meta-analytic examination of the relationship between EET and both entrepreneurship-related human capital assets and entrepreneurship outcomes. Our results were supportive of the notion that entrepreneurship-specific human capital formation can be influenced by entrepreneurship-specific education. This is important, given the heretofore equivocation of the narrative literature reviews on the subject, particularly in light of the immense growth and investment in entrepreneurship education on a global scale. We have also provided recommendations for improving the literature to enhance the value of future EET research results.

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TABLE 1
Summary of Studies Included in Meta-Analysis

	Authors	Year	Published	EET Type	Criterion Variable	Country	Sample Size	Rigor/ Random
1.	Athayde	2009	Yes	1	Human capital assets	UK	249	1
2.	Bege, Bjorvatn & Tungodden	2009	No	2	Entrepreneurship outcomes	Tanzania	430	2&3
3.	Brown, Bowlus & Seibert	2010	No	1	Human capital assets	USA	454	1
4.	Charney & Libecap	2000	No	1	Entrepreneurship outcomes	USA	511	1
5.	Chrisman & McMullan	2004	Yes	2	Entrepreneurship outcomes	USA	141	1
6.	Cooper & Lucas	2007a	No	2	Human capital assets	Scotland	37	1
7.	Cooper & Lucas	2007b	No	2	Human capital assets	Scotland	94	1
8.	Cruz, Escudero, Barahone & Leitao	2009	Yes	2	Human capital assets & Entrepreneurship outcomes	Spain	354	1
9.	DeTienne & Chandler	2004	Yes	1	Human capital assets	USA	130	2
10.	Fayolle & Gailly	2009	Yes	1	Human capital assets	France	158	1
11.	Fayolle, Gailly, & Lassas-Clerc	2006a	Yes	1	Human capital assets	France	20	1
12.	Fayolle, Gailly, & Lassas-Clerc	2006b	Yes	2	Human capital assets	France	144	1
13.	Fayolle, Lassas-Clerc & Tounes	2009	No	1	Human capital assets	France	383	1
14.	Friedrich & Visser	2006	Yes	1	Human capital assets	S. Africa	114	2
15.	Friedrich, Glaub, Gramberg, & Frese	2006	Yes	2	Human capital assets	S. Africa	34	2&3
16.	Garalis & Strazdiene	2007	Yes	2	Human capital assets	EU	103	1
17.	Gine & Mansuri	2009	No	2	Human capital assets & Entrepreneurship outcomes	Pakistan	1461	2&3
18.	Hanke, Warren & Kisenwether	2009a	No	1	Human capital assets	USA	362	1
19.	Hanke, Warren & Kisenwether	2009b	No	1	Human capital assets	USA	43	1
20.	Harris, Gibson & Taylor	2008	Yes	1	Human capital assets	USA	358	1
21.	Izquierdo & Buelens	2008	Yes	1	Human capital assets	Ecuador	274	1
22.	Jones, Jones, Packham & Miller	2008	Yes	1	Human capital assets	Poland	50	1
23.	Karlan & Valdivia	2008	No	2	Human capital assets &	Peru	3,431	2&3

TABLE 2
Coding and Frequencies of Variables

	K
Entrepreneurship-related Human Capital Assets	
Knowledge and skills	17
Knowledge of entrepreneurship and entrepreneurial process	11
Competency in identifying innovative business opportunities	5
Competency in dealing with ambiguity in decision making	2
Positive perceptions of entrepreneurship	
Attitudes towards entrepreneurship	10
Desirability of becoming an entrepreneur	5
Feasibility of becoming an entrepreneur	8
Self-efficacy for entrepreneurship	3
Intentions to become an entrepreneur	19
Entrepreneurship Outcomes	
Nascent behaviour	1
Start-up	6
Entrepreneurship performance	9
Success (Duration)	1
Success (Financial)	8
Personal income from owned business	1
Moderator	
Academic	24
Training	18
Methodology	
Below rigor threshold	31
Met rigor threshold	11
Nonrandom assignment	36
Random assignment	6
Publication Bias	
Published	29
Unpublished	13

TABLE 3

Meta-Analysis of Correlations of Entrepreneurship Education and Training with Entrepreneurship-Related Human Capital Assets and Entrepreneurship outcomes

Variable	Weighted mean r	SD_{ρ}	k	N	95% Confidence Interval	80% Credibility Interval	%SE	z-value
H1: EET and entrepreneurship-related human capital assets								
Overall	.217	.176	33	11,125	.157 - .277	-.007 - .442	7.9	0.668a
<i>Without large samples</i>	.184	.216	31	6,233	.107 - .260	-.092 - .460	9.0	
Knowledge & skills	.237	.169	17	8,334	.157 - .317	.021 - .453	5.9	
Positive perceptions	.109	.219	18	3,828	.008 - .210	-.170 - .389	8.6	
Intentions	.137	.243	19	3,314	.027 - .246	-.173 - .448	8.5	
H2: EET and entrepreneurship outcomes								
Overall	.159	.096	13	10,524	.107 - .211	.036 - .281	11.2	-1.550a
<i>Without large samples</i>	.207	.050	10	2,806	.176 - .238	.143 - .272	56.1	
Start up	.124	.082	6	6,706	.058 - .190	.020 - .228	11.3	
Performance	.166	.125	9	5,790	.084 - .248	.006 - .326	8.5	
H3a: Moderation of EET and entrepreneurship-related human capital assets								
Training	.246	.182	12	6,819	.143 - .349	.013 - .479	4.4	0.324a 1.056b
<i>Without large samples</i>	.210	.309	10	1,927	.019 - .402	-.186 - .606	4.7	0.290b
Academic	.180	.155	21	4,306	.113 - .246	-.019 - .379	15.7	

H3b: Moderation of EET and entrepreneurship outcomes									
Training	.151	.099	9	9,353	.086 - .216	.023 - .278	8.5	-0.026a -2.600**b	
<i>Without large samples</i>	.152	.046	6	1,011	.115 - .189	.094 - .211	73.2	-4.395***b	
Academic	.238	.011	4	1,795	.227 - .249	.225 - .252	94.5		
Methodology									
Below rigor threshold	.246	.143	31	6,424	.196 - .296	.063 - .428	17.2	1.990*	
Met rigor threshold	.142	.151	11	10,233	.053 - .231	-.052 - .335	5.1		
Nonrandom assignment	.212	.175	36	7,601	.155 - .269	-.013 - .437	12.2	0.909	
Random assignment	.156	.133	6	9,056	.050 - .262	-.014 - .326	3.4		
Publication Bias									
Published	.188	.204	29	5,729	.114 - .262	-.073 - .450	10.0	0.196	
Unpublished	.178	.123	13	10,928	.111 - .245	.021 - .336	6.7		

Note: Weighted mean r is the sample size weighted mean observed correlation across studies (mean rho), SD_p is the standard deviation of correlations after removing sampling error variance, K is the number of coefficients, N is the number of participants, %SE is the percent of sampling error, and the z-value is the statistic based on the test for significance of the difference in effect sizes; * $p < .05$, ** $p < .01$, *** $p < .001$; a = compared to “Without large samples”, b = compared to “Academic.”