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Effect of entrepreneurship education on entrepreneurship intention and related outcomes in educational contexts: a meta-analysis

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ABSTRACT

Although some meta-analyses have investigated the effect of Entrepreneurship Education (EE), they mixed studies with high and low methodological quality. Thus, their results might overestimate the impact. This paper aims to examine the efficacy of the EE in student samples, attending to studies with a pre-posttest design and a control group.

The results showed small effect sizes for EE in increasing Entrepreneurship Intention (EI) and Self-efficacy. Moreover, meta-regression confirmed that the duration of intervention programs predicted larger effect sizes for the EI. Finally, the practical implications of other potential moderator variables are discussed.

Credit author statement

Sara Martínez-Gregorio: Conceptualization, Methodology, Investigation, Formal analysis, Writing – Original Draft. Laura Badenes-Ribera: Methodology, Data Curation, Formal analysis, Writing – Original Draft. Amparo Oliver: Conceptualization, Methodology, Writing – review & editing.

1. Introduction

To the extent that education has a transformative role in societies, educational agents have shown a growing interest in Entrepreneurship Education (EE), especially in higher education (Alanazi, 2019; Lorz et al., 2013). Entrepreneurship is considered a crucial element for economic development that can be promoted and developed through education (Kuratko, 2005; O'Connor, 2013).

However, EE goes beyond entrepreneurs' production. It is a valuable skill for citizens' personal and not just for professional development. From the beginning, Joseph Schumpeter's in the 1940s describes entrepreneurs as agents of change. The Consortium for Entrepreneurship Education (2008) states that entrepreneurship is more than teaching someone how to run a business, it is also promoting critical thinking and sense of self-worth. Today's world challenges are both economic and social. It is essential to mobilize science, technology, and innovation not solely for encouraging economic benefits, but also for anticipating and responding to social problems (OECD, 2011).

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Researchers share the interest in EE. Consequently, research related to EE has significantly increased in recent years (Aparicio et al., 2019; Liñán & Fayolle, 2015). Despite this growth in scientific production, there is still no accord in the definition of "entrepreneurship education" (Liñán, 2004; Mwasalwiba, 2010; Pittaway & Cope, 2007). Bae et al. (2014) would simplify the issue in their study by stating that "by entrepreneurship education, we are referring to education for entrepreneurial attitudes and skills" (p. 219), leaving a broad framework where diverse interventions and programs would have space. Some scholars are sceptical about considering new venture creation as the main and unique educational objective of EE (Kuratko, 2005; Mwasalwiba, 2010). From a wider point of view, EE aims to promote entrepreneurial attitudes, spirit, and culture, which could be applied in different life fields.

Given the interest in the field and the mentioned increase in related publications, several authors have carried out literature reviews in order to pool the knowledge generated (Aparicio et al., 2019). Specifically, there has been a proliferation of reviews and meta-analyses that attempt to highlight and compile the evidence found regarding the efficacy or impact of these types of interventions (Alanazi, 2019; Bae et al., 2014; Brüne & Lutz, 2020; Kuratko, 2005; Longva & Foss, 2018; Lorz et al., 2013; Martin et al., 2013; Mwasalwiba, 2010; Nabi et al., 2017; Peterman & Kennedy, 2003).

Among the set of variables used to measure the impact of the interventions, entrepreneurship intention seems to occupy a principal place in the literature (Alanazi, 2019). As several authors recognized (Liñán & Fayolle, 2015; Rahm, 2019), a great part of the research on EE and entrepreneurship intention is based on the theoretical framework of the Theory of Planned Behavior (TPB) (Ajzen, 1985, 1991). According to this theory, planned behaviours (such as starting a business) can be predicted through intentions to carry out those behaviours. Furthermore, following this theory, entrepreneurship intention is influenced by three previous independent determinants: attitude towards entrepreneurship, subjective norm, and perceived behavioural control (Kolvereid, 1996).

According to the TPB, EE would not only directly affect entrepreneurship intention but it would also affect its antecedents (Rauch & Hulsink, 2015; Varamäki et al., 2015). For this reason, we can find studies of the efficacy of EE that include these antecedent variables to observe its possible change (for example, (González-López et al., 2019; Varamäki et al., 2015).

Apart from the TPB model, alternative approaches in literature could be found. Firstly, some authors propose to use the TPB model using Entrepreneurial Self-efficacy instead of Perceived Behavioural Control (for example, Kumar & Das, 2019; Rueda et al., 2018). Entrepreneurial self-efficacy is described as the personal confidence in their capability to achieve entrepreneurial goals (Chen et al., 1998).

Additionally, there are studies developed in the framework of Shapero's Entrepreneurial Event model (Shapero & Sokol, 1982). This model considers perceived desirability and perceived feasibility as the antecedents of entrepreneurship intention. Perceived desirability refers to how attractive or desirable is the behaviour. Instead, perceived feasibility is related to the perception of the capability to perform the behaviour (Lorz et al., 2011). Consequently, some impact studies include perceived desirability and perceived feasibility as variables to measure the effect of EE (for example, Costa et al., 2018; Dickel et al., 2019). Although the TPB and Shapero's model are the ones most commonly found in the literature, alternative models continue to emerge (Tomy & Pardede, 2020).

Having described what can be understood as the impact of EE, we return to the aforementioned literature reviews. There are two clear consensuses from the literature reviews of the impact of EE. Firstly, empirical studies on the impact of EE are contradictory (Bae et al., 2014; Longva & Foss, 2018; Lorz et al., 2013; Martin et al., 2013). We can find studies that show a positive impact (for example, Gielnik et al., 2015; Souitaris et al., 2007), as well as a negative one (for example, Mentoor & Friedrich, 2007; Oosterbeek et al., 2010), or non-significant (for example, Huber et al., 2014; Varamäki et al., 2015). Among the previously mentioned reviews, it is worth noting the presence of three meta-analyses (Alanazi, 2019; Bae et al., 2014; Martin et al., 2013). All of them included samples of nascent or active entrepreneurs and they found a small relationship between entrepreneurship and its possible results. Martin et al. (2013) suggest that the methodologically less rigorous studies cause an overestimation of the impact of the intervention programs.

This controversy regarding the effect of EE may be related to lack of methodological rigor in the investigations (Bae et al., 2014; Liñán & Fayolle, 2015; Longva & Foss, 2018; Martin et al., 2013; Nabi et al., 2017; Peterman & Kennedy, 2003). Several methodological reviews of the literature have pointed out a variety of weaknesses that might undermine confidence in the belief that EE can produce entrepreneurship. One of the methodological weaknesses in research design: most of the studies use one-group pretest-posttest and posttest-only with a non-equivalent comparison group (Liñán & Fayolle, 2015; Lorz et al., 2013; Rideout & Gray, 2013). Lorz et al. (2013) found 69% of studies applied solely posttest data collection. Moreover, only 31% of the reviewed studies applied pretest-posttest design, but 61% of them did not use a control group.

If we return to the aforementioned meta-analyses, it can be seen that specific inclusion criteria regarding methodologic aspects of the study design were not included in any of these meta-analyses. In this way, Martin et al. (2013) concluded that, of the 42 studies identified, only 11 investigations had a design with pre and post-treatment measures and a control group. In reviewing the meta-analysis of Bae et al. (2014), it has been concluded that, of the 73 articles included, only 8 share the aforementioned design characteristics.

To overcome this problem regarding the methodology of the studies, Longva and Foss (2018) proposed a review of the literature published before 2018 that had the following inclusion criteria: 1) quantitative measurement of the effect of EE, 2) participants had to be students at primary, secondary or tertiary level, 3) longitudinal study (with pre and posttest) and 4) design with a control group. They identified a total of 17 articles, which seem to show contradictory results.

The present paper aims to shed light by carrying out a meta-analysis to integrate the knowledge on the impact of EE specifically attending to studies with a rigorous methodological design. Additionally, this study is the first attempt to study the effect of EE in student samples without including nascent or active entrepreneurs. Consequently, the specific objectives were: (1) to compute the mean efficacy of the EE to improve entrepreneurship intention and other outcome measures such as Control, Attitude toward entrepreneurship, Self-efficacy, Feasibility, Desirability, and Need for achievement; (2) to analyse the heterogeneity among the effect size estimates; (3) to search for substantive (for example, treatment, participant, context) and methodological studies' characteristics

that can be statistically related to the effect size indexes and, thus, can account for the effect size variability.

2. Method

A meta-analysis was performed following the guidelines for Reporting Systematic Reviews and Meta-Analyses (Moher et al., 2009), and the recommendations proposed by the American Psychological Association Publications and Communications Board Task Force (Appelbaum et al., 2018, Table, 9, pp. 21–23).

The study selection criteria were partially based on those proposed by Longva and Foss (2018). In order to be included in the meta-analysis, each study should meet the following criteria: (1) to be an original, quantitative study; (2) to include a quantitative measure of EE impact; (3) participants in the study had to be students at primary, secondary o tertiary level (nascent entrepreneurs were not included); (4) due to the methodological aspects, the studies had to use pre and posttest design and (5) a control group; (6) to be written in English or Spanish; (7) available in full text; and (8) statistical data provided in the study had to allow us to calculate the effect sizes. No restrictions were included concerning cultural context, type of EE, or year of publication. The exclusion criterion was: case series studies or N = 1.

2.1. Search strategy of studies

A literature search for articles that meet the aforementioned requirements was conducted based on the two previous meta-analyses (Bae et al., 2014; Martin et al., 2013), whose bibliographic searches have been expanded until April 2020. In order to make exhaustive research, several databases were consulted: Web of Science, Scopus, PROQUEST, and Science Direct. The search was performed using different combinations of the following terms: “entrepreneurship training”, “entrepreneurship program”, “entrepreneurship curriculum”, “entrepreneurship education”, or “enterprise education”; and “impact”, “effect”, “outcome”, “learning”, “entrepreneurship intention”, “willingness to start a business” or “willingness to start a venture”. Additionally, the reference section of previous literature reviews and meta-analyses were reviewed to identify additional studies that meet the criteria. Specifically, the consulted literature

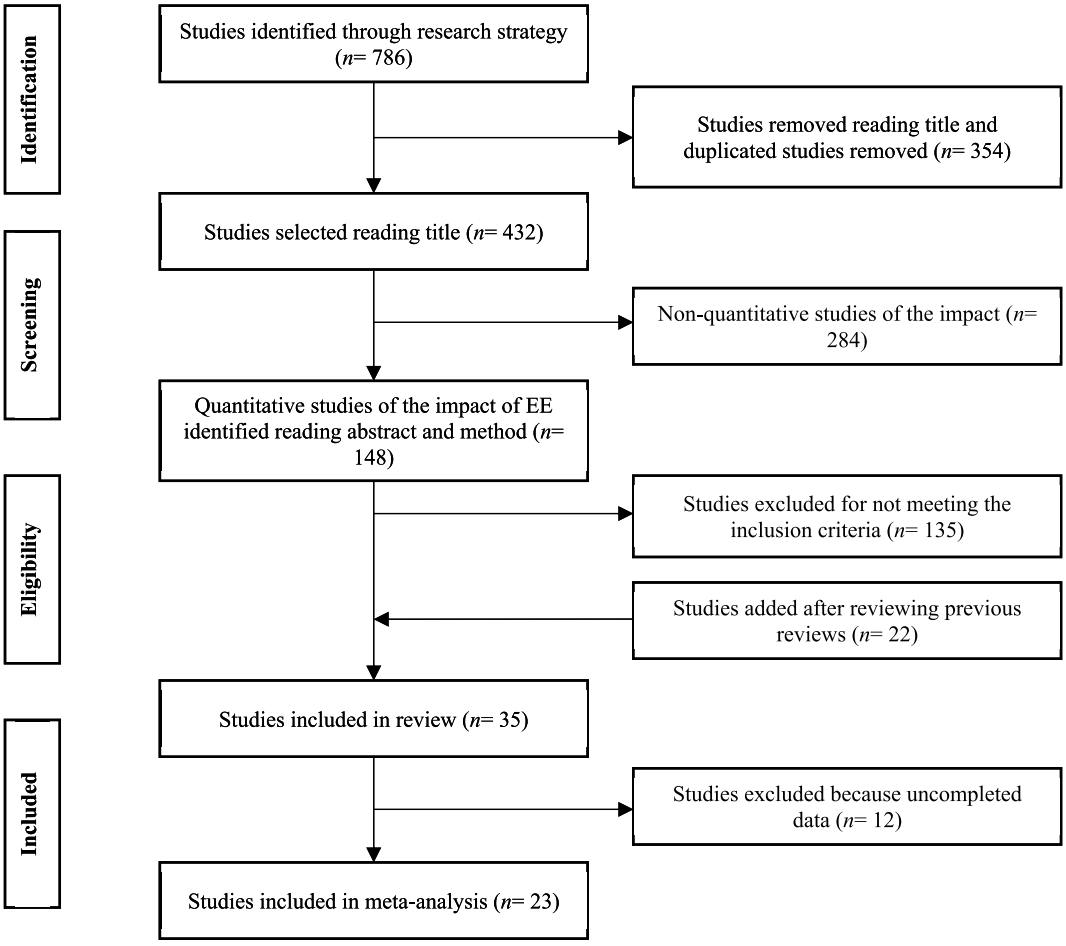

Fig. 1. *Stages in the process for selecting studies for the meta-analysis.*

reviews were: Bae et al. (2014), Brüne and Lutz (2020), Dickson et al. (2008), Longva and Foss (2018), Lorz et al. (2013), Martin et al. (2013), Mwasalwiba (2010), Nabi et al. (2017), Rahm (2019) and Rideout and Gray (2013). The process of screening and selection of the studies can be seen in Fig. 1.

The database search produced a total of 786 results. The titles of these articles were reviewed, and 432 studies were pre-selected, after removing duplicated ones. A total of 148 studies that carried out a quantitative measurement of the impact of EE were identified, only 13 of them fulfilled the inclusion criteria. Afterward, 22 additional articles that meet the criteria were identified reviewing the aforementioned previous reviews. Finally, a total of 35 were enclosed in the review. Nevertheless, twelve articles did not report on effect size or statistical data to compute it. Authors were emailed to obtain these data but they did not reply to the request. Thus, these studies were excluded from the meta-analysis. Consequently, the meta-analysis enclosed 23 published articles; all of them were published in a peer-reviewed journal, except Lorz et al. (2011), between 1998 (Hansemark, 1998) and 2020 (Cera et al., 2020). Four of the 23 articles provided data of two (Dickel et al., 2019; Ismail et al., 2018; Varamäki et al., 2015), and three (Mentoor & Friedrich, 2007) independent samples. Therefore, the database for the meta-analysis included a total of 28 independent samples.

2.2. Coding of the studies

Studies' characteristics were extracted in a standardized and systematic manner applying to each study the protocol established. The characteristics extracted were: (1) year of the study; (2) geographical location; (3) sample size (total and by groups); (4) mean age (total and by groups); (5) sex distribution (total and by groups); (6) education level (primary, secondary or tertiary); (7) outcome; and (8) statistics reported to calculate the effect sizes. Finally, methodological quality was measured using an *ad hoc* 12- dichotomous item checklist (see Appendix 1) based on checklists previously used and in other methodological reviews (Lorz et al., 2013; Maher et al., 2003; Sánchez-Meca et al., 2014).

Each item rated 1 when the study met the criteria and 0 if the criteria are not met or the information is not available to evaluate it. A total quality score is calculated by adding up the results of all the criteria. The total score range between 0 and 12, a higher score means higher quality.

The inter-rater reliability for methodological quality was satisfactory, with an intraclass correlation of 0.979. Minimum inconsistencies between coders were resolved by consensus, and a third reviewer was consulted if necessary.

2.3. Computing effect sizes

Although all studies enclosed in the meta-analysis ($n = 23$) employed a research design pretest-posttest with a control group, some of them ($n = 7$) did not report statistical data to compute the effect size for the control group. The lack of statistical data for control groups conditioned the selection of the effect size index. Consequently, the analysis unit was the group, not the study, and the effect size index was the standardized mean change scores index (d), computed as the difference between the posttest and means divided by the standard deviation within groups. Because d has a slight positive bias, the unbiased estimate called Hedges' g was applied: $g = c(m) * d$, $c(m)$ being a correction factor for small sample sizes (Hedges & Olkin, 1985). To control some of the validity threats of this effect size index, the d index was computed for both intervention and control groups, separately. And then, an adjusted average effect was used, d_{adj}, computing the difference between the average d indices of the intervention groups, d_I, and the control, d_C, groups ($d_{adj} = d_I - d_C$). The adjusted index allowed us to control the testing effects and, thus, it offers a more appropriate estimate of the true intervention effect. Positive values for d represented a favourable change in the group from the pretest to the posttest. According to Campbell and Stanley's (1966) criteria, effect sizes of 0.2, 0.5, and 0.8 can be interpreted as reflecting small, moderate, and large effect sizes, respectively.

Separate effect sizes were calculated for Entrepreneurship intention, Control, Attitude towards Entrepreneurship, Self-efficacy, Feasibility, Desirability, Need for achievement and Subjective norm.

To measure the reliability of the effect size computations a double process of effect size calculations was performed. The inter-coder reliability was excellent, with a mean intra-class correlation of 0.88 ($SD = 0.18$). In addition, the calculation for which the raters disagreed was discussed and easily resolved by consensus.

2.4. Statistical analysis

Independent meta-analyses were conducted with the effect sizes for each outcome measured in at least 3 independent samples. As not all studies measured all outcomes, each meta-analysis enclosed a different number of studies, which ranged from 20 to 3 studies. Random-effects models were assumed in the statistical calculations (Borenstein et al., 2009). For each meta-analysis, a pooled standardized mean change difference and its corresponding 95% confidence interval (CI) were calculated. Additionally, the statistical significance of the pooled standardized mean difference was examined by the Z test.

Forest plots were elaborated to display the individual and pooled effect size estimates, with their 95% CIs, and to allow visual inspection of variability among effect sizes. Additionally, both Cochran's Q-statistic and the I^2 index were calculated (Higgins et al., 2003). A Q-statistic with $p < .05$ denoted a variability among the effect sizes. I^2 index values of around 25%, 50%, and 75% indicated low, moderate, and large variability, respectively (Huedo-Medina et al., 2006).

To assess the potential effect of moderator variables on effect size heterogeneity, weighted analyses of variance (ANOVAs) were performed for categorical variables and meta-regressions for continuous variables, by assuming a mixed-effects model (Borenstein et al., 2009; López-López et al., 2014). The statistical significance was assessed with the Q_B statistic for categorical moderators and Q_R

statistic for continuous moderators. Additionally, an estimate of the proportion of variance accounted for by the moderator variable was calculated (López-López et al., 2014; Raudenbush, 2009). The model misspecification was assessed with the Q_W statistic for categorical moderators and the Q_E statistic for continuous moderators.

Lastly, to examine publication bias, a funnel plot with Duval and Tweedie's trim-and-fill method for imputing missing data and the Egger test were performed (Duval & Tweedie, 2000; Sterne & Egger, 2005). When there are fewer than 10 studies the power of Egger's test is insufficient to distinguish chance from genuine asymmetry (Higgins & Green, 2011).

The statistical analyses were conducted using the Comprehensive Meta-analysis software program version 3.0 (Borenstein et al., 2014), and were interpreted assuming a significance level of 5% ($p < .05$) and, using two-tailed tests.

3. Results

3.1. Descriptive characteristics of the studies

Appendix 2 displays a summary of the studies' characteristics included in the systematic review. As it can be seen, 17 articles have been found after the years of publications of the previous meta-analysis (Bae et al., 2014; Martin et al., 2013). It should be noted that 82.85% of them have been carried out with university population.

Overall, all studies used a convenience sample selected from primary schools ($n = 1$), secondary schools ($n = 5$) or university ($n = 29$) setting and a pre-post design with control group. A large number of studies were conducted in Europe ($n = 22$), with three of them being carried out in the United States of America (USA) and the other five in Asia, three in Africa, and two in Australia.

Regarding the participants' characteristics, the mean age of all participants ranged from 11.63 to 26 years, with a mean age of 21.12 ($SD = 3.70$). The percentage of females ranged from 21% to 70%, with an average percentage of 51.5 ($SD = 12.69$). Eleven studies did not report on the age and/or sex distribution of participants.

Teaching methods. Another difference among entrepreneurship programs is the teaching method used (Mwasalwiba, 2010). It seems that previous research sorts teaching methods into two categories: "passive methods" (also known as "traditional methods" or "teacher-centered methods") and "active methods" (also known as "innovative methods" or "student-centered methods" (Ismail et al., 2018; Mwasalwiba, 2010; Varamäki et al., 2015).

The studies identified were classified according to this categorization. Those that included an approach focused on student's experiences were considered as "active methods" and they should include activities as participating in real companies, making a business plan, or virtual simulations (Varamäki et al., 2015). The most used teaching method is "active methods" ($n = 26$), whereas only 6 studies used "passive methods". Two papers specifically studied the effect of the teaching method (Ismail et al., 2018; Varamäki et al., 2015). Categorization is found in Appendix 2.

Outcomes measures. The 35 articles have been classified according to the dependent variables that were taken into consideration in the study to see the effect of the intervention. Specifically, 10 variables have been measured most frequently in the literature (see Appendix 2). The most analysed outcome was the entrepreneurship intention ($n = 22$), followed by control ($n = 12$), self-efficacy ($n = 12$), and attitude toward entrepreneurship ($n = 9$). The outcome least frequently examined was social orientation ($n = 2$) followed by feasibility, risk-taking, and need of achievement ($n = 5$), desirability, and subjective norm ($n = 6$).

Additionally, a set of entrepreneurial skills as proactivity (Huber et al., 2014; Sánchez, 2013) or innovation (Mentoor & Friedrich, 2007) are often considered. However, they have not been investigated in a sufficient number of studies to be included in the meta-analysis and these variables are sufficiently different from each other that they cannot be considered as a whole.

3.2. Methodological quality assessment

The detailed results obtained from methodological quality assessment, that is, the scores of individual studies on each quality item and the Total Quality Score (TQS) are available under request. The TQS was obtained by adding up the 1s and 0s for the checklist items

Table 1
Results for the effect sizes according to the outcome measure for the intervention and control groups.

	Intervention groups						Control groups					
			95% CI						95% CI			
Outcome measure	k	d_+	dl	du	Q	I^2	k	d_+	Dl	du	Q	I^2
Entrepreneurship intention	20	0.215	0.098	0.332	243.854***	92.2	12	0.008	−0.125	0.141	97.63***	88.7
Control	10	−0.007	−0.327	0.312	372.514***	97.6	4	−0.020	−0.160	0.120	7.497***	56
Attitude	8	0.020	−0.141	0.182	58.905***	88.2	3	0.031	−0.112	0.173	4.308***	53.6
Self-efficacy	7	0.337	0.159	0.514	120.258***	95	4	0.002	−0.085	0.090	7.744*	61.3
Feasibility	5	0.139	−0.100	0.379	24.247***	83.5	4	−0.161	−0.361	0.040	9.929***	69.8
Desirability	5	0.031	−0.056	0.118	4.803	16.7	3	0.187	−0.234	0.609	16.239***	87.7
Need for achievement	5	0.044	−0.243	0.331	119.596***	96.7	3	−0.048	−0.234	0.139	7.598*	73.7
Subjective norm	4	0.058	−0.167	0.284	22.424***	86.6	1	0.075	−0.018	0.168	–	–

Note: *$p < .05$. **$p < .01$. ***$p < .001$.95% C·I.: 95% confidence interval. k: number of studies. d+: mean effect size. dl and du: lower and upper confidence limits. Q: heterogeneity statistic. I^2: heterogeneity index (%).

Group by Subgroup within study	Study name	Hedges's g	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
CG	Cera et al. (2020). CG	0,286	0,044	0,002	0,200	0,371	6,565	0,000
CG	Dickel et al. (2019). CG Bangladesh	0,538	0,116	0,013	0,312	0,765	4,655	0,000
CG	Dickel et al. (2019). CG Germany	-0,022	0,136	0,018	-0,287	0,244	-0,159	0,874
CG	García-Rodríguez et al. (2016). CG	-0,230	0,138	0,019	-0,501	0,042	-1,658	0,097
CG	Gielnik et al. (2015). CG	-0,094	0,063	0,004	-0,217	0,028	-1,506	0,132
CG	Gielnik et al. (2017). CG	0,082	0,076	0,006	-0,068	0,231	1,068	0,285
CG	González-López et al. (2019). CG	0,044	0,048	0,002	-0,049	0,137	0,921	0,357
CG	Ismail et al. (2018). CG	0,079	0,075	0,006	-0,069	0,226	1,045	0,296
CG	Nabi et al. (2018). CG	-0,054	0,098	0,010	-0,246	0,138	-0,552	0,581
CG	Rauch et al. (2015). CG	-0,682	0,116	0,013	-0,909	-0,455	-5,897	0,000
CG	Sukavejworakit et al. (2018). CG	-0,019	0,138	0,019	-0,288	0,251	-0,134	0,893
CG	van Ewijk et al. (2019).CG	0,061	0,072	0,005	-0,081	0,202	0,842	0,400
CG		0,006	0,074	0,006	-0,139	0,152	0,087	0,931
IG	Cera et al. (2020)	0,474	0,058	0,003	0,361	0,587	8,228	0,000
IG	Dickel et al. (2019). Bangladesh	-0,101	0,108	0,012	-0,313	0,111	-0,935	0,350
IG	Dickel et al. (2019). Germany	0,021	0,072	0,005	-0,120	0,162	0,290	0,772
IG	Drishtiet al. (2016)	0,066	0,075	0,006	-0,081	0,212	0,881	0,378
IG	García-Rodríguez et al. (2016)	0,206	0,208	0,043	-0,202	0,613	0,990	0,322
IG	Gielnik et al. (2015)	0,127	0,057	0,003	0,015	0,239	2,226	0,026
IG	Gielnik et al. (2017)	0,797	0,079	0,006	0,642	0,952	10,061	0,000
IG	González-López et al. (2019)	0,596	0,048	0,002	0,503	0,690	12,515	0,000
IG	Hanke et al. (2005)	0,126	0,092	0,009	-0,054	0,307	1,372	0,170
IG	Ismail et al. (2018). Teacher	0,032	0,071	0,005	-0,108	0,171	0,444	0,657
IG	Ismail et al. (2018). Student	0,050	0,083	0,007	-0,112	0,212	0,606	0,544
IG	McStay (2008)	0,113	0,056	0,003	0,003	0,223	2,011	0,044
IG	Nabi et al. (2018)	0,065	0,082	0,007	-0,095	0,225	0,800	0,424
IG	Rauch et al. (2015)	0,603	0,089	0,008	0,429	0,778	6,773	0,000
IG	Sánchez (2013)	0,306	0,043	0,002	0,222	0,391	7,105	0,000
IG	Souitaris et al. (2007)	0,315	0,071	0,005	0,176	0,454	4,444	0,000
IG	Sukavejworakit et al. (2018)	0,921	0,166	0,027	0,596	1,245	5,558	0,000
IG	van Ewijk et al. (2019)	0,089	0,067	0,005	-0,043	0,221	1,327	0,184
IG	Varamäki et al. (2015). Active	-0,185	0,117	0,014	-0,415	0,044	-1,583	0,113
IG	Varamäki et al. (2015). Lecture	-0,369	0,162	0,026	-0,686	-0,052	-2,285	0,022
IG		0,215	0,057	0,003	0,103	0,328	3,751	0,000

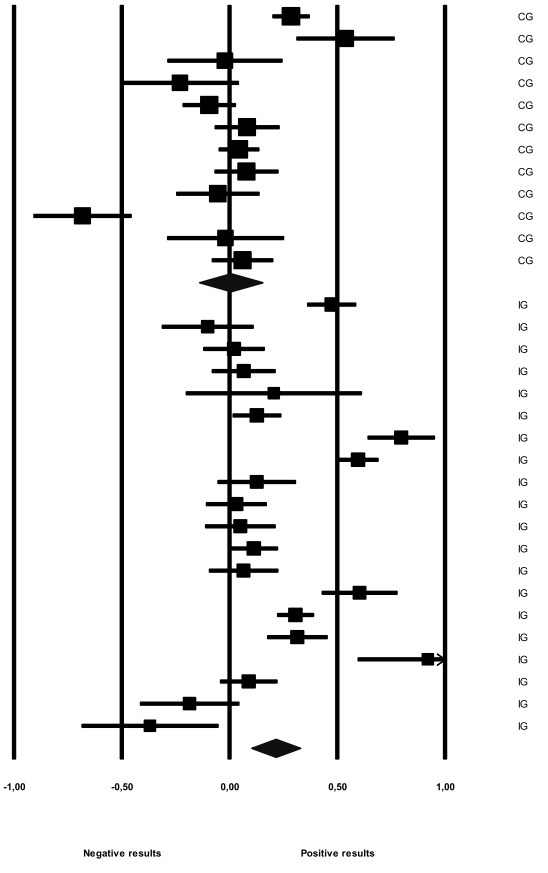

Fig. 2. *Forest plot EE on entrepreneurship intention.*

(range = 0–12). The average methodological quality score of the studies was 8.97 ($SD = 1.62$ Mode = 10), ranging from 6 to 12 points.

All of studies applied appropriate statistical tests (non-parametric vs. parametric methods) to measure the effect ($n = 35$) and did not dichotomize the assessment of dependent variables ($n = 35$). In addition, most of them met the following criteria: (a) the expected effect was theoretically based ($n = 34$); (b) they provided a detailed description of entrepreneurship intervention which included learning objectives ($n = 25$), intervention duration ($n = 20$) and/or pedagogical methods used ($n = 27$); (c) they had an adequate sample size in the posttest ($n = 24$); (d) they employed measurement instruments with good psychometric properties (validity and reliability) to assess dependent variables ($n = 25$); (e) they reported results of between groups statistical comparison for at least one key outcome ($n = 34$), and (f) they had no private financial support ($n = 32$).

However, most of the studies did not run a random assignment of the participants to control and intervention group ($n = 5$), and only in the 50% of them, control and intervention groups were similar at baseline regarding important indicators ($n = 18$).

3.3. Synthesis of results

Table 1 displays the results of the meta-analysis obtained separately for the intervention groups and the control groups in each outcome measure. In most of them, there was not a statistically significant average effect of EE for the intervention groups. The results only revealed a statistically significant average effect of EE for the intervention groups on Entrepreneurship intention and Self-efficacy scores.

Focusing on the Entrepreneurship intention, the results revealed a statistically, significant average effect for the intervention groups ($d_+ = 0.215$, $k = 20$), whereas the average effect for the control groups was practically null ($d_+ = 0.008$, $k = 12$). Moreover, a weighted ANOVA employed to compare the two average effects revealed statistically significant differences between both (Q_B (1) = 4.938, $p = .026$, $R^2 = 0.09$). Nevertheless, the average d index obtained for the intervention groups may be overestimating the true effect (due to its low internal validity). To resolve this issue and controlling the testing effects suffered by these d indices, an adjusted average effect, d_{adj}, was defined and computed as the difference between the average effect of the intervention groups, d_I, and the average effect of the control groups, d_C: $d_{adj} = d_I - d_C$. Thus, for the global measures of Entrepreneurship intention an estimate of the true treatment effect was $d_{adj} = 0.215–0.008 = 0.207$, an effect estimate that can be considered of small magnitude (Cohen, 1988). Fig. 2 shows a forest plot for the Entrepreneurship intention classified as a function of the intervention groups and the control groups.

Regarding to Self-efficacy, the results revealed a statistically, significant average effect for the intervention groups ($d_+ = 0.337$, $k = 7$), whereas the average effect for the control groups did not yield statistical significance ($d_+ = 0.002$, $k = 4$). When the two average effects were statistically compared, the difference between them led to a statistically significant difference, (Q_B (1) = 7.053, $p = .008$, $R^2 = 0.24$). The difference between the two average effects provided an adjusted effect size of a small to medium magnitude: $d_{adj} = 0.337–0.002 = 0.335$ (Cohen, 1988). Fig. 3 shows a forest plot for the Self-efficacy classified as a function of the intervention groups and the control groups.

3.4. Moderator analysis

As Table 1 presents, effect sizes for the intervention groups exhibited large variability in Entrepreneurship intention and other outcome measures, with I^2 ranging between 83.5% and 97.6%, except to desirability outcome ($I^2 = 16.7$). Hence, an analysis of the studies' characteristics that might influence the effect size heterogeneity was performed. However, due to the few studies and some studies not reporting sociodemographic variables, it was impossible to conduct further analyses that might explain the heterogeneity of effect sizes for most of the meta-analyses carried out. It was only possible to perform a moderator variables analysis for Entrepreneurship intention measures ($k = 20$) by sample characteristics (for example, mean age, percentage of females, geographical location, and socio-economic context by country), study characteristic (for example, year publication and methodological quality), and intervention characteristics (for example, duration in months). Specifically, weighted ANOVAs for categorical moderator variables and simple meta-regression for continuous moderator variables were used, with the standardized mean change as the dependent variable.

Table 2 shows the results of the weighted ANOVAs performed on the categorical variables, such as the continent where the study was conducted, the socio-economic context of the country where the study took place, which was coded as Emerging market and

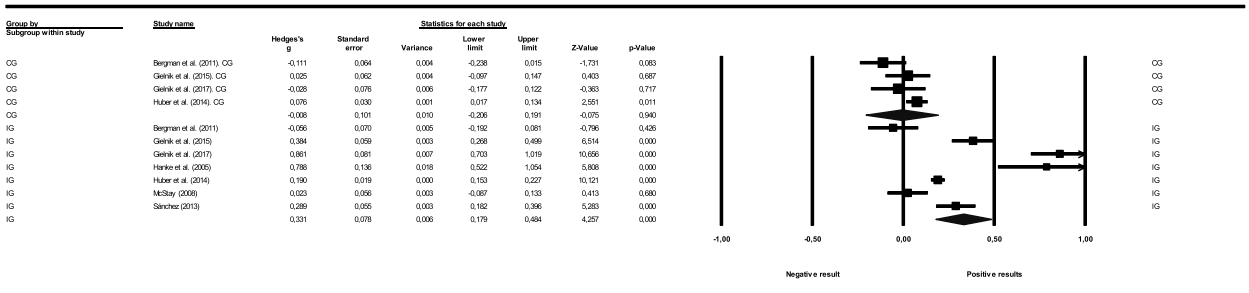

Fig. 3. *Forest plot EE on self-efficacy.*

developing economies and Advanced economies, following the International Monetary Fund (IMF) classification (International Monetary Fund, 2020). The results of the ANOVA did not reach statistically significant values on examined categorical variables. Nevertheless, focusing on the continent where the study was conducted, only the studies carried out in Europe ($d_+ = 0.208$, $k = 11$) or Africa ($d_+ = 0.455$, $k = 2$) reached a small to moderate and statistically significant mean effect.

On the other hand, focusing on the socioeconomic context for the country, for both groups, a small and statistically significant mean effect was obtained. Specifically, for the Advanced economies the mean effect was $d_+ = 0.178$ ($k = 11$), and for the Emerging market and developing economies the mean effect was $d_+ = 0.259$ ($k = 9$).

Table 3 presents the simple meta-regressions performed on continuous variables, such as mean age, and gender (% female) of the sample, as well as the duration of the intervention program. The only moderator variable that yielded a statistically significant relationship with effect sizes was the duration of the intervention program for the individual studies, accounting for 23% of the variance ($p < .05$).

3.5. Analysis of publication bias

Of the 8 funnel plots elaborated (available under request), the trim- and-fill method required the imputation of effect sizes in two of them to achieve symmetry. One of these was the funnel plot that showed the effect size for the feasibility measures. In this case, Duval and Tweedie's method imputed one effect estimate. However, the adjusted average d ($d_+ = 0.068$; 95% CI [-0.168, 0.305]) presented a slight difference from the original average d ($d_+ = 0.139$). The other asymmetrical funnel plot displayed the meta-analysis of the effect size for the desirability measures. In this case, Duval and Tweedie's method imputed two effect estimates, but, the adjusted average d ($d_+ = 0.027$; 95% CI [-0.052, 0.106]) presented a negligible difference from the original average d ($d_+ = 0.031$).

In addition, the Egger test yield statistical significance only for the meta-analysis of attitude measures ($p = .004$, $k = 8$) and subjective norm ($p = .21$, $k = 4$) (see Table 4). Consequently, based on the results of these different analyses, publication bias can reasonably be ruled out as a threat to meta-analytic findings.

4. Discussion

The objective of this research was to perform a meta-analysis to investigate the efficacy of EE interventions on entrepreneurship intention and other outcome measures, specifically attending to studies carried out in the academic context with a pre and posttest design and a control group. As for the maximum value is 12, the mean methodological quality score of 8.97 for all the studies enclosed in this systematic review ($n = 35$) represents moderate-to-large quality, enhancing the credibility of the conclusions.

The findings clearly show that there was not a statistically significant average effect of EE for the intervention groups on most of the outcome measures. There was only a statistically significant average effect of EE for the intervention groups on Entrepreneurship Intention ($d_+ = 0.215$) and Self-efficacy scores ($d_+ = 0.337$). As aforementioned, given the problems with the internal validity of the d index obtained from one-group designs, an adjusted average effect was used, d_{adj}, calculating the difference between the average d indices of the intervention, d_I, and the control. The adjusted index for Entrepreneurship intention was $d_{adj} = 0.207$, an effect estimate that can be considered of small magnitude (Cohen, 1988), and for Self-efficacy was $d_{adj} = 0.335$, an effect estimate that can be considered of small to medium magnitude (Cohen, 1988).

These results found in academic samples with high methodological rigor agree with the findings of previous meta-analyses. Although its small or medium magnitude, a positive relationship between EE and entrepreneurship intention and entrepreneurship-related human capital assets was established (Bae et al., 2014; Martin et al., 2013). Although the lack of methodological rigor may have overestimated the results (Martin et al., 2013), they still occur in similar sizes in more rigorous studies.

It has been argued that the variability of results in the primary studies may be due to the diversity of programs, lengths, and samples used in the impact studies (Longva & Foss, 2018; Lorz et al., 2013). Nevertheless, there are other tentative explanations in the literature. Fretschner and Lampe (2019) focused on the "alignment" and "sorting" effects to explain the controversial results related to the impact of EE on entrepreneurship intention. The alignment effects explain how the students with low entrepreneurship intention at the beginning of the course will increase their entrepreneurship intention because they might find something they would enjoy in

Table 2
Results of the weighted ANOVAs for the influence of categorical variables on the effect sizes.

Moderator variable	k	d_+	95% CI		ANOVA results
			dl	du	
Geographic location:					
Europe	11	0.208	0.046	0.370	Q_B (3) = 2.042, $p = .564$;$R^2 = 0.0$; Q_W (16) = 202.821, $p < .001$
Asian	5	0.167	−0.075	0.409	
Africa	2	0.455	0.087	0.823	
Others (USA, Australia)	2	0.119	−0.251	0.490	
Socioeconomic context for country:					
Advanced economies	11	0.178	0.013	0.343	Q_B (1) = 0.419, $p = .517$; $R^2 = 0.0$, Q_W (18) = 242.171, $p < .001$
Emerging market and developing economies	9	0.259	0.079	0.438	

Note. C.I.: 95% confidence interval. k: number of studies. $d+$: mean effect size. dl and du: lower and upper confidence limits. $_+$. Q_B: between-categories Q statistic. Q_W: within-categories Q statistic. R^2: proportion of variance accounted for by the moderator variable.

Table 3
Results of the simple weighted meta-regressions of continuous moderators on the effect sizes for Entrepreneurship intention measures.

Moderator variable	*k*	b_j	Q_R	Q_E	R^2
Participant characteristics:					
Mean age (years)	10	−0.0192	0.32	126.16***	0.0
Gender (% females)	16	−0.0007	0.02	219.83***	0.0
Intervention characteristics:					
Duration (months)	15	0.0538	4.68*	118.60***	0.23
Study characteristics:					
Year publication	20	0.0067	0.15	236.86***	0.0
Number items used to assess EI	19	−0.0330	1.52	235.45***	0.02
Methodological quality checklist (0-12)	20	0.0239	0.32	243.47***	0.0

k: number of studies. b_j: unstandardized regression coefficient. Q_R: *Q* statistic to test for the moderator variable significance. Q_E: *Q* statistic to test for model misspecification. R^2: variance accounted for by the moderator variable. *$p < .05$. ***$p < .001$.

Table 4
Analyses of Publication Bias with the Egger Test.

Outcome	*K*	Intercept	SE	T	*df*	*p*-value
Entrepreneurship intention	20	−2.650	2.346	1.1309	18	.273
Control	10	−4.94	5.48	0.90	8	.303
Attitude	8	−6.84	1.50	4.57	6	.004
Self-efficacy	7	3.170	2.92	1.09	5	.326
Feasibility	5	3.09	3.63	0.85	3	.457
Desirability	5	−0.43	1.45	0.30	3	.784
Need for achievement	5	−2.94	3.97	0.74	3	.514
Subjective norm	4	−5.36	0.79	6.75	2	.021

Note: SE: Standard error; T: T-test; *df*: Degrees of freedom.

entrepreneurship. This effect is contrary for the students with high entrepreneurship intention before the course, who will acquire a more realistic view of entrepreneurship. The alignment effect could affect other variables in the same way.

Publication bias was ruled out as a threat to the meta-analytic findings, and a large heterogeneity was found among the individual effect sizes. However, it was only possible to perform moderator variables analysis to determine the studies' characteristics that might explain at least part of the effect size heterogeneity for Entrepreneurship intention measures, due to few studies and the fact that some of them did not report on sociodemographic variables. Findings from moderator analysis revealed that only the intervention duration was statistically related to effect sizes. Specifically, studies with longer intervention duration produce more change in entrepreneurship intention. As Oosterbeek et al. (2010) claimed, the duration of the entrepreneurship programs is an interesting research area. Our results reinforce the statement of Oosterbeek et al. (2010) and contradict the results of Lorz et al. (2011), who found that the duration of the program only affected the perceived behavioural control. Consequently, although most of the courses taught in the university context last approximately one semester, it would be advisable to extend the duration of the courses to consolidate the acquisition of the outcomes of interest.

Previous research shows cultural differences in entrepreneurship intention (Iakovleva et al., 2011; Shneor et al., 2013). Our study suggests that the differential effectiveness of EE is not the reason for these differences. The country or socio-economic context (advanced vs. emerging markets) has not shown moderator effects. It means that entrepreneurship programs are being equally effective despite the country of application. Although the effect of subjective norms on entrepreneurship intention varies across the country (Moriano et al., 2012), the programs seem to be well adapted to each context.

4.1. Limitation and strengths

Some limitations should be acknowledged. First, our study focuses on evaluating the impact at the second level of the Kirkpatrick model (Kirkpatrick, 1996), that is, we do not measure the impact of the programs directly on behaviour. However, this approach continues to be the predominant perspective in evaluating the impact of programs carried out in educational contexts and this study collects previous literature.

Second, the meta-analysis is based on few studies, given that twelve studies could not be enclosed in the final analysis because they did not provide the statistical data necessary to compute the effect sizes. Moreover, some of the included studies did not supply statistical data to calculate the effect size for the control group. Consequently, the effect size index was the standardized mean change scores index for intervention and control groups, separately. To resolve the problems with the internal validity of this effect size and provide a more realistic estimate of the true effect, an adjusted average effect was used, d_{adj}, calculating the difference between the average *d* indices of the intervention and the control groups.

Additionally, most of the studies enclosed in this meta-analysis used convenience samples taken from a University setting, which limits the generalization of these results to other education levels. Consequently, it is necessary to conduct more research on the EE effect in other levels of education (for example, secondary level).

On the other hand, the lack of information in primary studies on variables related to participants' characteristics or intervention characteristics limited our ability to analyse moderating variables that could explain heterogeneity across studies. Therefore, it is possible that other moderator variables not considered might be relevant in explaining this variability (for example, intervention characteristics). Moreover, some primary studies did not provide all the information needed to code all moderator variables enclosed in the meta-analysis.

However, several strengths should also be mentioned. Foremost, this study employs a meta-analytic approach to examine the impact of EE, specifically attending to studies with a rigorous methodological design, pooling estimates across a wide range of studies. The rigorous selection of the studies tried to assure the quality of the evidence. Thereby, it was more relevant to summarize the evidence selecting studies with high methodological quality than to review and synthetize a larger number of studies with poor methodological quality. Consequently, this meta-analysis allows a more accurate view of the impact of EE, with the limitations mentioned above. In addition, international studies are enclosed in this meta-analysis and, consequently, results are not country-specific, which strengthens the external validity of this study.

4.2. Recommendation for future research

Throughout the discussion, recommendations for future research arising from the current findings and review of the literature have been identified (for example, Lorz et al., 2013; Rideout & Gray, 2013). These suggestions include (1) representative sampling of participants (for example, probabilistic sampling with diverse recruiting methods), (2) samples selected from secondary level and in vocational schools; (3) detailed information about the intervention program (for example, duration, pedagogical methods, so on); (4) validity and reliability tests to assess outcome measures; (5) detailed information about descriptive statistics for outcome measures (for example, means and standard deviations) for both intervention and control group, separately, in pretest and posttest phases, (5) detailed information about potential moderators to advance theoretical understanding (for example, sociodemographic characteristics of the participants). This would not only facilitate the carrying out of meta-analyses, but also the replication of primary studies and the comparison of different studies.

Recent research has highlighted the need to explore the intention-behaviour gap. Students may lose their entrepreneurial intention because of the difficulties they face as independent entrepreneurs (Harima, Gießelmann, Göttsch, & Schlichting, 2021). Consequently, it is recommended to study the effect directly on entrepreneurial behaviour with longitudinal follow-up (Rahm, 2019).

Additionally, future research should deepen in the process through which the EE impacts the entrepreneurship outcomes. Ndofirepi (2020) found that psychological traits as need for achievement partially mediated the relationship between EE and entrepreneurial intention.

5. Conclusion

The present study contributes clarifying the effectiveness of entrepreneurship programs in an essential context: the educational field without including nascent entrepreneur samples. Additionally, it is based exclusively on methodologically rigorous studies. As a result, these programs have shown effectiveness in promoting entrepreneurship intention and self-efficacy across the students. These results support the development of initiatives to boost entrepreneurship in educational centers, with samples that have not necessarily shown prior interest in entrepreneurship.

Furthermore, it is still necessary to improve the quality of impact studies of EE and the reporting of its results. To continue deepening the knowledge of the moderating variables of the impact of the programs, we need the research works to provide detailed information on the procedures used in the entrepreneurship programs. Rigorous and comprehensive efficacy studies are needed to learn about good practices that guarantee the desired results with methodologies adapted to each education stage.

Declaration of competing interest

The authors declare no conflicts of interest.

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Appendix 1. Checklist for assessing the methodological quality of the studies

Item	Description
1	Expected effect was theoretically based (Yes: 1; No: 0)
2	Detailed description of entrepreneurship intervention 1. It includes learning objectives. (Yes: 1; No: 0)
3	Detailed description of entrepreneurship intervention 2. It includes duration. (Yes: 1; No: 0)

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Item	Description
4	Detailed description of entrepreneurship intervention 3. It includes pedagogical methods. (Yes: 1; No: 0)
5	Randomized control and treatment group (Yes: 1; No: 0)
6	Groups were similar at baseline regarding important indicators (Yes: 1; No: 0; Unable to determine: 0)
7	Adequate sample size in the posttest (Yes: 1; No: 0)
8	The assessment of dependent variables was not dichotomized (Yes: 1; No: 0)
9	The measurement instrument used to assess dependent variables shows good psychometrics properties (validity and reliability) (Yes: 1; No: 0; Unable to determine: 0)
10	The statistical test used to assess the effect was appropriated to the data (non-parametric vs. parametric) (Yes: 1; No: 0)
11	Results of between groups statistical comparison are reported for at least one key outcome (Yes: 1; No: 0)
12	Absence of private financial support (Yes: 1; No: 0)

Note: The methodological quality checklist is based on 12 dichotomous criteria. The presence of the criterion is given a 1 point and its absence 0. The maximum possible score is 12.

Appendix 2 General characteristics of the studies

	Study	Country		Mean Age	Sex Distribution (% female)	Education level	Duration	Teaching methods	Outcome measured
1.	Athayde (2012)	UK	200 intervention 76 control	–	44.92	Secondary	1 year	AM	A
2.	Bergman et al. (2011)	Israel+1	122 intervention 144 control	14.26	54.96	Secondary	1 year	AM	SE
3.	Cera et al. (2020)	Albania	200 intervention 328 control	–	60.4	Tertiary	–	–	EI
4.	Costa et al. (2018)	Portugal and Germany	181 intervention 102 control	21	55	Tertiary	4 weeks	PM	F
5.	DeTienne and Chandler (2004)	United States	71 intervention 59 control	24	45.9	Tertiary	4 months	PM	–
6.	Dickel et al. (2019)	Germany and Bangladesh	164 intervention 81 control	22.48	40.82	Tertiary	4 months	AM	D, EI, F
7.	Drishti et al. (2016)	Albania	106 intervention 80 control	–	52	Tertiary	4 months	AM	A, C, EI
8.	Fernández-Pérez et al. (2019)	Spain	640 intervention 111 control	22	62.3	Tertiary	4 months	–	C, EI, SE, SN
9.	García-Rodríguez et al. (2016)	Spain	22 intervention 52 control	–	63.43	Tertiary	4 months	AM	D, EI, F
10.	Gielnik et al. (2015)	Uganda	184 intervention 153 control	24.6	40	Tertiary	3 months	AM	EI, SE
11.	Gielnik et al. (2017)	Kenya	125 intervention 102 control	24.6	22.5	Tertiary	3 months	AM	EI, SE
12.	González-López et al. (2019)	Spain	310 intervention 264 control	20.9	55	Tertiary	8 months	AM	A, C, EI, SN
13.	Hahn *et al.* (2020)	Austria, Estonia, Germany, Hungary, Italy, Poland, Spain, Switzerland	101 intervention 324 control	25.57	59.5	Tertiary	–	–	–
14.	Hanke et al. (2005)	USA	70 intervention 70 control	–	–	Tertiary	4 months	AM	D, EI, F, SE
15.	Hansemark (1998)	USA	19 intervention 50 control	21.92	44.9	Tertiary	1 year	AM	C, NA
16.	Huber et al. (2014)	Netherlands		11.63	50.3	Primary		AM	NA, SE, RT

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(*continued*)

	Study	Country		Mean Age	Sex Distribution (% female)	Education level	Duration	Teaching methods	Outcome measured
			1729 intervention 684 control				2–4 weeks		
17.	Ismail et al. (2018)	Malaysia	203 intervention 105 control	20.13	70	Tertiary	4 months	Both	EI
18.	Karlsson and Moberg (2013)	Denmark	51 intervention 21 control	26	28.78	Tertiary	–	AM	A, SE
19.	Lorz et al. (2011)	Switzerland	119 intervention 153 control	22.1	–	Tertiary	4 months	AM	A, C, EI, SN
20.	McStay (2008)	Australia	190 intervention 239 control	21	43.2	Tertiary	4 months	AM	D, EI, SE
21.	Mentoor and Friedrich (2007)	South Africa	418 intervention 45 control	–	–	Tertiary	4 months	PM	C, NA
22.	Nabi et al. (2018)	UK	89 intervention 61 control	18–25	55	Tertiary	–	AM	C, EI
23.	Oosterbeek et al. (2010)	Netherlands	104 intervention 146 control	–	45	Tertiary	1 year	AM	NA, SE, RT
24.	Peterman and Kennedy (2003)	Australia	109 intervention 111 control	16.18	61.9	Secondary	5 months	AM	D, F
25.	Rauch and Hulsink (2015)	Netherlands	88 intervention 54 control	23.54	21	Tertiary	1 year	AM	A, C
26.	Sánchez (2011)	Spain	404 intervention 460 control	22.5	64.2	Tertiary	8 months	AM	EI, SE, RT
27.	Sánchez (2013)	Spain	347 intervention 363 control	15.7	57.46	Secondary	8 months	AM	EI, SE, RT
28.	Schroder and Schmitt-Rodermund (2006)	Germany	321 intervention 302 control	16.4	53.08	Secondary	–	PM	C, EI
29.	Souitaris et al. (2007)	UK and France	124 intervention 126 control	–	–	Tertiary	5 months	AM	A, C, EI, SN
30.	Sukavejworakit et al. (2018)	Thailand	30 intervention 30 control	–	–	Tertiary	–	AM	EI
31.	Thursby et al. (2009)	USA	71 intervention 15 control	–	–	Tertiary	2 years	AM	–
32.	van Ewijk and Belghiti-Mahut (2019)	Arab Emirates	132 intervention 114 control	22.47	68.7	Tertiary	4 months	–	EI
33.	Varamäki et al. (2015)	Finland	66 intervention 131 control	23	61	Tertiary	–	Both	A, C, EI, SN
34.	Volery et al. (2013)	Switzerland	189 intervention 102 control	19.3	46	Tertiary	6–12 months	AM	D, NA, SE, RT
35.	Zampetakis et al. (2015)	Greece	60 intervention 51 control	25.3	66.8	Tertiary	3 months	–	A, C, EI, SN

Note: AM: Active method; PM: Passive method; A: Attitude towards entrepreneurship; C: Control or Perceived Behavioral Control; D: Desirability; EI: Entrepreneurship intention; F: Feasibility; NA: Need for achievement; SE: Self-efficacy; SN: Subjective Norm; RT: Risk-taking.

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