

Review

# Entrepreneurship Education and Sustainable Development Goals: A literature Review and a Closer Look at Fragile States and Technology-Enabled Approaches

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Received: 2 August 2019; Accepted: 23 September 2019; Published: 27 September 2019



**Abstract:** Entrepreneurship has the potential to reduce poverty, stimulate economic growth and boost innovation, in addition to enhancing social and environmental sustainability. In accordance with the human capital theory and previous empirical studies, it is assumed that entrepreneurship education and training (EET) directly correlates with positive entrepreneurial outcomes and therefore sustainable development. Although several scholars have attempted to review and analyze EET literature over the past decade, none of these reviews directly links EET with sustainable development or focuses on the role and status of EET (research) in less-stable areas of the world. This systematic review thus attempts to analyze recent literature to identify the extent to which EET research addresses Sustainable Development Goals (SDGs). The review identifies several gaps in research and practice that potentially hinder EET from adequately advancing sustainable development, including a dearth of research on fragile states and demographic diversity, limited EET access to non-university students and a general lack of focus on educational technology, progressive education approaches, and innovation in fragile countries compared to stable ones. The review also identifies challenges pertaining to EET resource constraints in fragile contexts. The paper concludes by offering insights on how educational technology could mitigate EET challenges in fragile environments to ultimately ease some barriers towards SDG advancement and provides recommendations for future research directions.

**Keywords:** Sustainable Development Goals; entrepreneurship education and training; fragile states; educational technology

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## 1. Introduction

Two billion people currently live in countries impacted by fragility, conflict and violence, with the percentage of individuals living in extreme poverty in conflict-affected areas expected to rise to more than 60% by 2030 [1]. High (youth) unemployment levels in fragile contexts not only hinder economic development, but also contribute to violence and conflict [2]. For instance, evidence from the Sahel region shows that the social stigma accompanying poverty and unemployment drives youth to join armed groups in pursuit of social recognition [3], while the lack of economic opportunity and the promise of a regular income have driven many Syrians to join extremist groups [4]. Without youth engagement in the labor market, the vicious cycle of poverty and violence cannot be broken.

Realizing the importance of economic empowerment to achieve Sustainable Development Goals (SDG), the United Nations (UN) has been increasingly focusing on entrepreneurial interventions to support ambitious youth to start their own businesses and generate employment opportunities for themselves and others [5]. Entrepreneurship has also been shown to contribute to advancing social and environmentally sustainable development areas with positive impacts in the areas of financial inclusion,

empowerment of women, sustainable farming, and minority integration, among many others [6]. Entrepreneurship therefore has direct positive impacts specifically towards poverty alleviation (SDG 1), economic development and unemployment reduction (SDG 8), enhancement of infrastructure and innovation (SDG 9), social equality and inclusion (SDGs 5 and 10) and sustainable production and consumption (SDG 12).

Empowering individuals with sufficient academic education creates the necessary human capital to enhance product and process innovation [7], while specialized entrepreneurship education and training (EET) enhances entrepreneurship-related human capital, skills and behaviors [8,9]. Particularly in contexts of fragility and poverty, where unskilled entrepreneurs predominate and small business activities are mostly of a low-growth, survivalist nature [10–12], EET is vital in allowing entrepreneurship to reach its full potential. Suboptimal access, quality, and regulation of formal education systems in several less-developed countries [13], however, call for innovative means of delivering entrepreneurial capacity-building interventions beyond—in addition to within—the walls of traditional formal education institutions.

Adaptive learning technologies could provide significant value in less-developed countries by supporting and supplementing their educational needs [14], while enabling personalization of learning, establishing connections between learners, increasing student engagement, and providing access to various learning materials [15]. With even the world's least-developed countries currently exhibiting rapid growth in technology adoption [16], there is little reason digitalization cannot become a friend of, rather than a threat to, the advancement of global sustainable development.

Despite recent advancements in the EET research field and the publication of several literature reviews and meta-analyses in the area [8,9,17,18], little research connects the EET literature with sustainable development and, to my knowledge, none has been found that directly analyzes EET's relationship to SDGs. Realizing EET's vital role in enhancing entrepreneurship in advancement of (at least) six SDGs, it is important to understand the target beneficiaries, approaches, outcomes and tools employed by current EET initiatives and their representation in highly reputable entrepreneurship journals.

This paper therefore features a systematic literature review inspired by Eichler and Schwartz [19], where recent entrepreneurship publications in the EET area are analyzed with respect to their contribution to SDGs 1, 5, 8, 9, 10 and 12. Though the review revealed adequate emphasis on outcomes pertaining to SDG 8, several gaps in research and practice are identified that potentially hinder EET from advancing other SDGs, including a dearth of research on fragile states and demographic diversity, limited EET access to non-university students and a general lack of focus on educational technology, progressive education approaches and innovation in fragile countries compared to stable ones.

An analysis of key obstacles hindering EET from achieving its sustainable potential in fragile contexts follows. The prevalence of traditional education, lack of qualified teachers, lack of funding and limited access to EET appear to challenge several less-stable countries. Educational technology, particularly ITS, is proposed as mitigation to those challenges grounded by examples of successful implementations in various fields of education across several developing-country contexts.

## 2. Theoretical Background

Indeed, both replicative and innovative entrepreneurs [20] have been shown to be instrumental for sustainable development. Replicative ones who start new businesses regardless of whether similar firms are already present in the market are important in fighting poverty [21], enhancing competition and increasing product supply [22]. Therefore, replicative entrepreneurs could be expected to contribute to reducing poverty and tackling unemployment, directly advancing SDGs 1 and 8. However, it is the innovative entrepreneurs who provide new services and goods needed by the public, create a learning environment for future entrepreneurs, commercialize knowledge and new ideas, generate (longer-term) profitability and instigate endogenous change which has the potential to disrupt the status quo [10,23–26]. They therefore have the additional advantage of contributing to

SDG 9 through fortifying local infrastructure, stimulating homegrown technology development and enhancing sustainable industrialization. Certainly, numerous innovations stemming from low-resource environments and poverty-stricken entrepreneurs have proven their contribution to sustainable development, as seen through examples in the green energy and healthcare technology sectors in Kenya and India [27,28].

Entrepreneurship has the potential to advance social and environmental sustainability in addition to economic sustainability. For instance, supporting female entrepreneurship contributes to women empowerment, improving quality of life, as well as economic growth and entrepreneurial diversity [29–31], hence directly contributing to the advancement of SDG 5. Migrant and refugee entrepreneurship also enhances social integration, empowerment and psychological wellbeing, reduces dependency on welfare and foreign aid, creates employment opportunities for other newcomers and stimulates domestic entrepreneurship [32–36], providing evidence of entrepreneurship's capability to reduce inequality and enhance social cohesion (support for SDG 10). Additionally, recent green entrepreneurial innovations in agriculture, packaging, energy and manufacturing have the potential to directly enhance sustainable production and consumption (support for SDG 12) [37,38].

In accordance with the human capital theory, possession of higher levels of knowledge, skills and relevant competencies is positively correlated with labor market productivity, underscoring the importance of investment in human capital to enhance economic development [39]. In relation to entrepreneurship in particular, it is argued that proper education at secondary and post-secondary levels enhances the formation of a creative and inventive population with the necessary business start-up skills [7].

This is further validated by large-scale studies on EET. Based on a meta-analysis of 42 independent samples consisting of 16,657 cases, EET is found to enhance entrepreneurship-related human capital, knowledge and skills, positive perception of entrepreneurship, intention to seek entrepreneurship, entrepreneurship outcomes and startup performance [8]. Another study on 11,230 individuals in 32 countries shows that entrepreneurship education at the school level has a positive correlation with subsequent entrepreneurial activity, particularly in institutional environments with lower corruption control and financial capital availability [9].

Realizing that EET impacts could differ depending on the context and audience, it is important that EET be provided to youth at various stages and in different settings. A World Bank study summarizing findings from 230 EET program evaluations in developing countries concludes that entrepreneurship education at the secondary level encourages entrepreneurial behavior and the development of relevant socio-emotional skills, while at the post-secondary level enhances the development of entrepreneurial capabilities and mindsets [17]. The study also shows that entrepreneurship training for potential entrepreneurs positively impacts their business practices and helps them in launching new businesses, while it can support practicing entrepreneurship in accessing financial capital. This clearly shows the importance of providing EET at various levels outside of advanced, stable economies.

With the notion that EET positively correlates with entrepreneurial activity, I therefore assume that EET initiatives have the potential to advance several SDGs. Accordingly, EET initiatives focusing on outcomes such as business creation, innovation and technology and/or environmentally conscious product and service development have the potential to advance SDGs 8, 9 and 12, respectively. Meanwhile, EET initiatives targeting the low-income, women and girls and/or minority groups have the potential to advance SDGs 1, 5 and 10, respectively.

Naturally, provision of education and training alone cannot be expected to achieve its goals without considering how they are delivered. John Dewey classifies education as "traditional" versus "progressive", where traditional education involves standardized knowledge transmission from a teacher to students who are largely passive recipients of knowledge [40]. On the other hand, progressive education considers each learner's capacities and interests and focuses on individual learning-by-doing, shifting the teacher's role to a knowledge facilitator rather than provider. Traditional educational approaches therefore contradict the desire for empowerment, change and inventiveness that

entrepreneurship education seeks to achieve and have even been associated with lower entrepreneurial intentions [41], calling for progressive approaches in which learning and experience are merged to mirror future workspaces and emphasize critical thinking, reflection and collaboration [40,42].

Additionally, the general relevance of traditional education is now less than ever given that learners can access a myriad of knowledge sources through digital means even in several less-developed and fragile settings [14]. There is therefore a higher need for specialists to support learners in organizing and prioritizing knowledge rather than its mere provision, while utilizing digital means and educational technology given their extraordinary potential to enhance the quality, outcomes and accessibility of education and learning [43,44], with EET being no exception.

The conceptualization of EET's contribution to SDG advancement is portrayed in Figure 1.

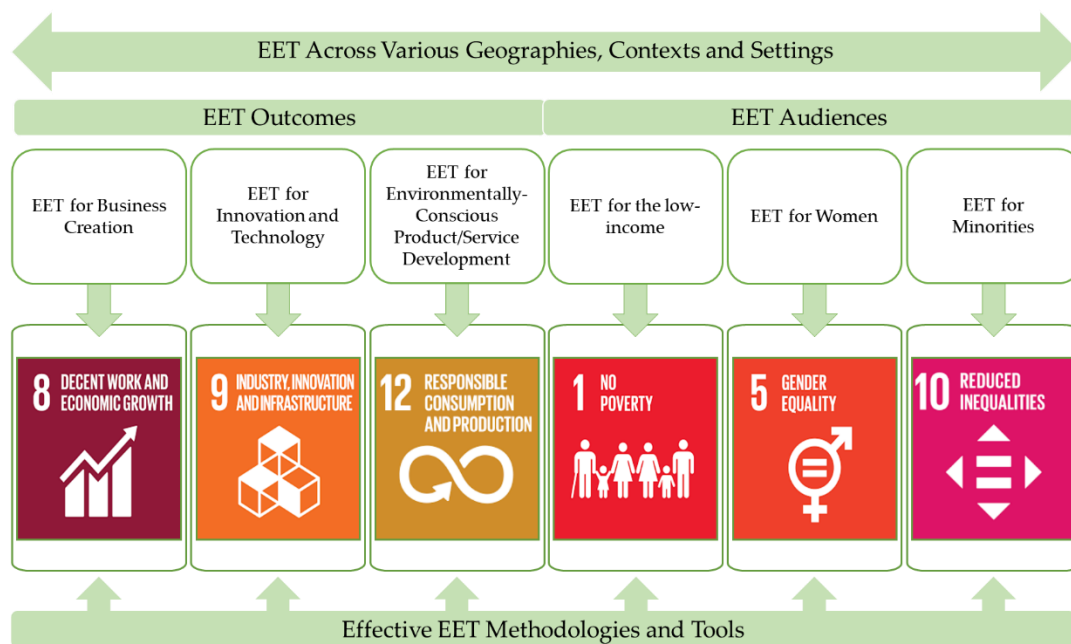
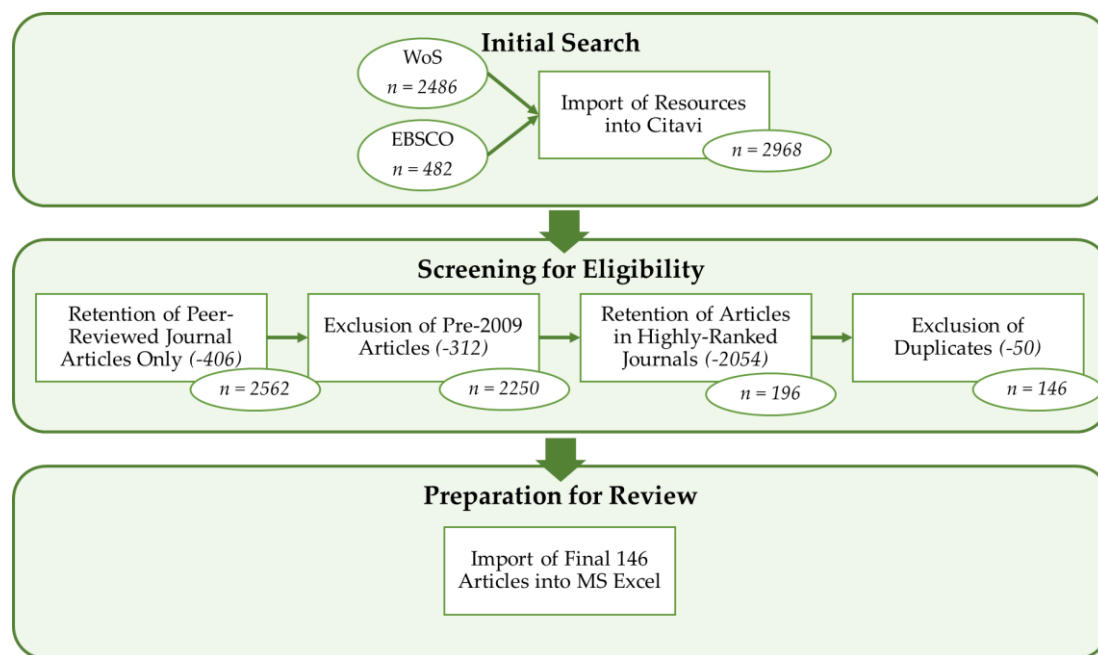


Figure 1. Conceptual framework.

### 3. Systematic Review of EET Literature

A systematic literature review was conducted following Tranfield et al.'s methodology and the PRISMA guidelines [45,46] (a systematic literature review is one in which scientific evidence is reviewed in a repeatable, transparent, and analytical manner that could inform policy and practice [45]) to examine entrepreneurship literature's contribution to sustainable development in accordance with the theoretical framework. Therefore, EET literature in mainstream, high-impact entrepreneurship journals was reviewed to identify the main geographies and settings, target audiences, desired outcomes and common methodologies and tools employed by recent EET initiatives. The process and results of the systematic review are summarized in Figure 2.



**Figure 2.** Summary of the systematic literature review process.

This was initiated by searching for scholarly works that contain the keywords/terms “entrepreneurship” and “education”, “entrepreneurial” and “education”, “entrepreneurship” and “training”, “entrepreneurial” and “training” or “sustainable development” and “entrepreneurship” in their titles in the Web of Science (WoS) and EBSCO Business Source Complete databases using Citavi Reference Management Software, resulting in 2486 WoS and 483 EBSCO entries. WoS was used due to its comprehensive coverage of literature in social sciences, the humanities and technology [47] and was preferred to other similar databases such as SCOPUS due to its coverage of journals with generally higher impact compared to SCOPUS [48]. Meanwhile, EBSCO was used, as it is considered one of the most complete business studies databases [49].

The resulting database was extracted to Microsoft Excel, and resources published before 2009 were removed, as more recent literature has higher relevance in terms of informing current research, policy and practice recommendations. Books and book chapters were also removed from the database.

The resulting 2250 entries were then filtered by selecting peer-reviewed journal articles published in the 37 most highly ranked entrepreneurship journals according to the German Academic Association for Business Research (VBH) [50]. Peer-reviewed journal articles were mainly chosen, as they are considered highly validated and impactful knowledge sources [51]. The reason for focusing explicitly on highly ranked entrepreneurship journals embodies a response to two recent calls for action from entrepreneurship scholars. The first of these was Wiklund et al.’s [52] criticism of business research as being too little focused on solving real problems, with entrepreneurship research in particular being one field where social relevance can and should be combined with theoretical rigor, including focusing on many aspects of sustainable development. The second was Welter et al.’s [53] call to diversify entrepreneurship research beyond silicon-valley-like contexts and without disregarding specific social groups from entrepreneurship research due to their perceived lack of economic contribution, hence implicitly labeling them as “unimportant”. This analysis therefore sheds light on whether and how established entrepreneurship journals are indeed shifting focus to sustainable development as desired target and outcome of entrepreneurship and on the demographic diversity and social inclusion of various groups as research subjects, particularly within the ever-growing research subfield of EET.

The resulting 196 resources were then analyzed for duplicates, leading to the removal of an additional 50 (repeat) entries. The analysis then began for the remaining set of 146 journal articles. After reading all the abstracts, the articles were classified based on their type (empirical, theoretical/review,

book review) to give an overview of the literature characteristics. Articles for which no access was given, those featuring no empirical analysis or case studies of EET programs or featuring an empirical analysis or case studies on non-EET initiatives (e.g., general education or technology transfer) were marked as excluded from further analysis with regards to EET impact on SDGs.

The 79 remaining articles were then thoroughly analyzed by scanning their full texts and summarizing key findings relevant to their contribution to SDG advancement. The articles were categorized based on several criteria. Firstly, target geography was considered in two different ways: classification by “region” was performed according to the seven administrative world regions defined by the World Bank [54] and classification by “fragility” was done according to the Fragile State Index (FSI) developed by The Fund for Peace (FFP) [55]. The FFP created the FSI based on a Conflict Assessment System Tool (CAST) that assesses the vulnerability of a state to collapse in pre-, active- and post-conflict situations based on 12 cohesion, economic, political and social indicators. The FSI considers 178 states and classifies them in 4 categories – alert, warning, stable, and sustainable—based on their FSI scores, with the highest-scoring states classified as “alert”, and the lowest-scoring as “sustainable”.

Resources were also categorized according to the nature of EET, focusing on education/training setting as well as the demographic diversity of target EET recipients (with focus on SDGs 1, 5 and 10). Additionally, key desired EET outcomes relevant to advancing SDGs 8, 9 and 12, whether education is provided in a traditional or progressive manner and the use of educational technology were documented. Finally, EET challenges were identified based on the reviewed literature with a specific focus on initiatives in less-stable countries (warning/alert FSI classification).

#### 4. Findings and Discussion

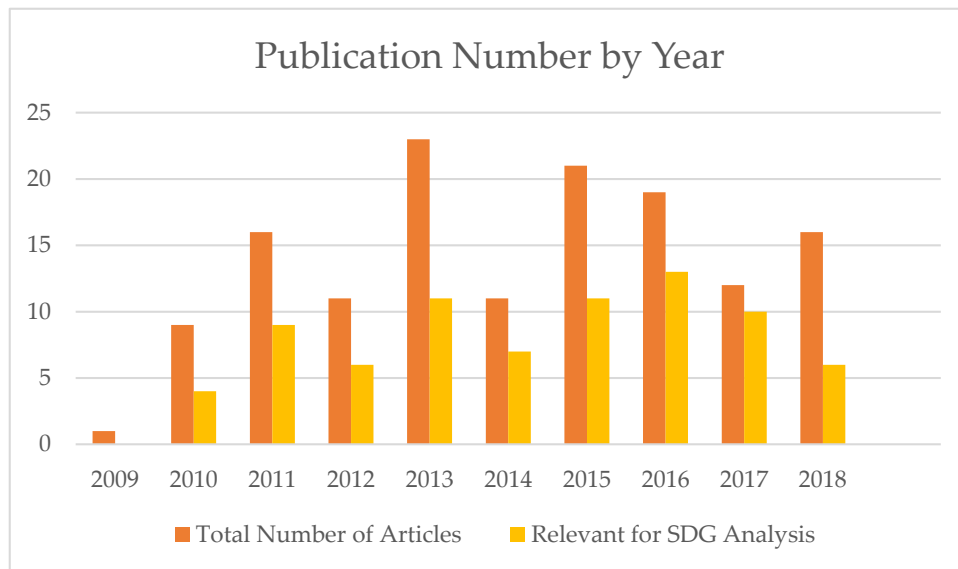
The majority of analyzed studies appear to be of an empirical nature, with a focus on EET programs within higher education institutions. Of these, several papers feature descriptive case studies of EET, where the design, expected outcomes and challenges of specific EET programs are outlined while highlighting unique features such as teaching philosophies, pedagogical approaches and innovative curricula (e.g., [56–59]). On the other hand, most of the quantitative studies in the review appear to use self-reported questionnaires administered to EET program participants to evaluate EET outcomes such as entrepreneurial intention and motivation (e.g., [60–62]), opportunity recognition (e.g., [63,64]) and self-efficacy (e.g., [65,66]). Very few studies appear to have employed longitudinal approaches (e.g., [66–68]) or non-self-reported questionnaires (e.g., [69,70]). Additionally, with a few exceptions (e.g., [71,72]), most of the reviewed empirical studies do not appear deeply rooted in theory.

A smaller proportion of the reviewed papers are of conceptual or review nature. A few of those studies introduce conceptual models and theoretical frameworks for the assessment and evaluation of EET programs (e.g., [73,74]), while others involve systematic literature reviews and meta-analyses of the methods and impacts of published EET literature (e.g., [75,76]). However, none of those literature review or conceptual papers appear to analyze EET explicitly in the sustainable development context.

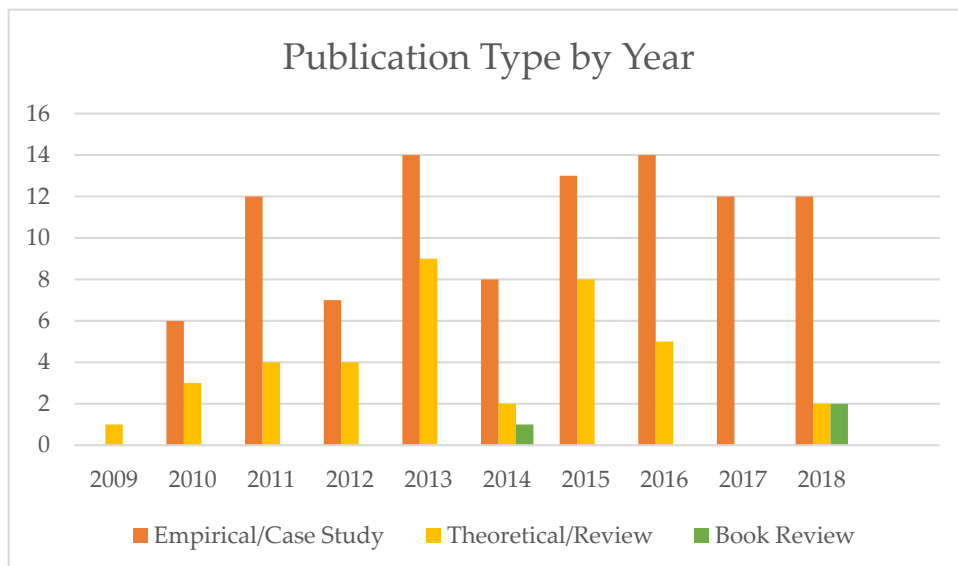
The following subsections feature a deeper dive into the nature, context and impact of the analyzed literature with respect to SDGs.

##### 4.1. Bibliometrics

As seen in Figures 3 and 4, there appears to be an increase in academic interest in EET over the past 10 years, with the majority of the articles being of empirical nature. The year 2019 is not included in the figures, given that only the first half of the year is represented thus far.



**Figure 3.** Publication number by year.



**Figure 4.** Publication type by year.

#### 4.2. Country Context

The analyzed articles were classified according to their respective target regions and country fragility levels as seen in Figures 5 and 6. The vast majority of the reviewed EET initiatives target the Europe and Central Asia region (51%) and about 16% focus on North America. Only 10% of the articles handle EET programs in the Sub-Saharan African region, 10% of the articles focus on the East Asia and Pacific region, 6 articles handle the Middle East and North Africa covering Egypt (3 articles), Iran (2 articles), Israel (1 article) and Turkey (1 article), 2 articles are in South Asia (1 in Pakistan and 1 in India) and 1 article is based in Latin America and the Caribbean (Brazil). Three of the reviewed articles cover several/all global regions.

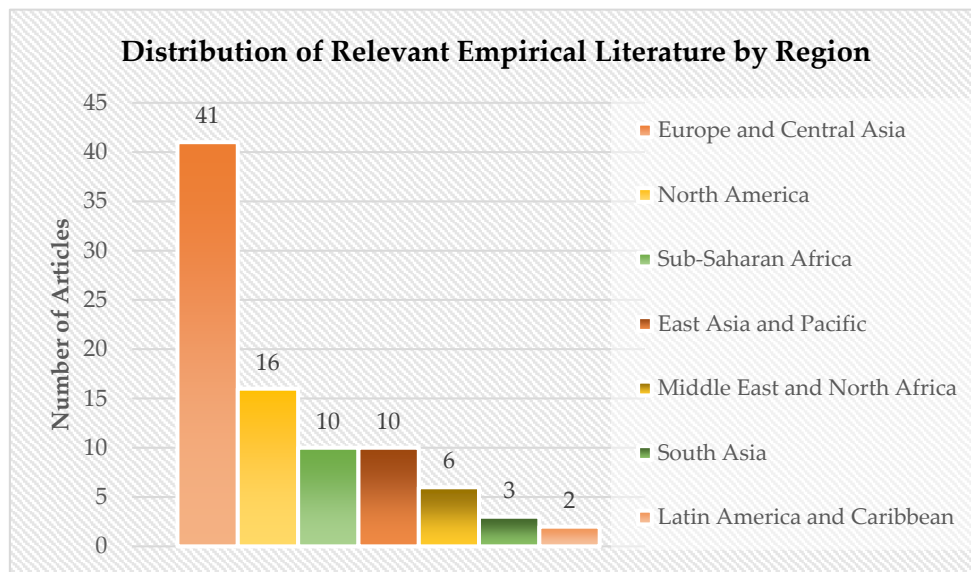


Figure 5. Distribution of relevant empirical studies by World Bank economic region.

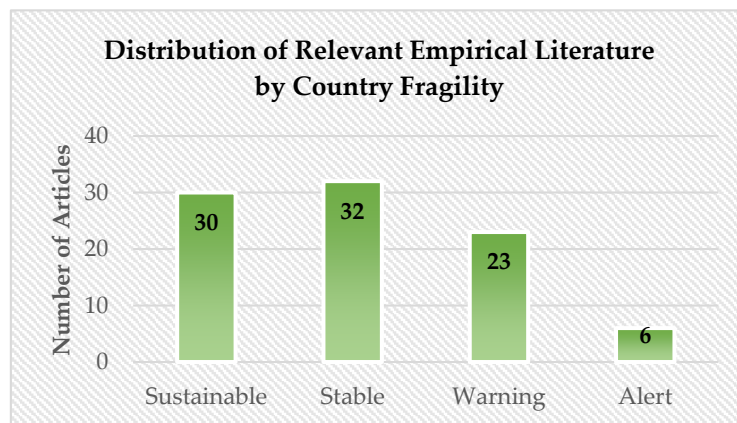


Figure 6. Distribution of relevant empirical studies by FSI fragility classification.

Clearly, scientific interest in EET is largely focused on advanced economies. Indeed, with respect to country fragility, only 29 articles handle countries ranking among the 50% less-stable in the world [55], though many handle countries such as China, Indonesia, Ghana and Ukraine, which are officially not considered fragile contexts by OECD standards [77]. In fact, only 8% of the reviewed articles handle country contexts classified as alert and are therefore of high fragility.

This could indicate that EET in the world's more underprivileged areas, which are in the most pressing need for sustainable development, does not receive much attention from entrepreneurship scholars. Either little research is done in those parts of the world, or the research is of quality that did not match the review criteria. This could also signal difficulty in conducting research in fragile states, the preference of researchers to conduct studies based on ease regardless of social importance and/or a general lack of EET initiatives in those locations.

Conducting research in fragile countries, particularly those affected by extreme inequality and violent conflict, can indeed be challenging [78], hindered by issues of informed consent, safety of researchers and research subjects, cultural misunderstandings, emotional well-being of field researchers and lack of researcher training. This could explain why no research was found on countries such as Syria, Afghanistan and South Sudan, which rank among the world's most fragile countries and from which over 55% of global refugees originated in 2017 [79], despite a crucial need for understanding



and implementing sustainable development efforts in those countries. Those research issues are ones that intelligent technologies can support the mitigation of, as will be seen later in this paper (Section 6).

#### 4.3. Recipients

As seen in Table 1, a striking 78% of the reviewed literature handles EET courses and programs for university students, with a few case studies discussing EET at the school level (13%) and vocational training institutions (3%). Only a handful of studies focus on recipients outside of academic institutions such as the unemployed and those already running their own business.

**Table 1.** Summary of EET recipients by age group/educational settings and demographic diversity.

EET Recipients	All		Sustainable/Stable Countries		Warning/Alert Countries	
	#	%	#	%	#	%
<b>By Age Group/Educational Setting</b>						
University Students	61	78	42	75	24	83
School Students	10	13	8	14	2	7
Small Business Owners	5	6	4	7	2	7
Unemployed Adults	5	6	4	7	1	3
Students in Vocational Training Institutes	2	3	2	4	0	0
General Public	3	4	3	5	0	0
Academic Staff	1	1	1	2	1	3
<b>By Demographic Diversity</b>						
Low-Income Individuals	6	8	3	5	4	14
Women/Girls	4	5	1	2	3	10
Minority Groups	2	3	1	2	1	3

This identifies a clear gap in scientific research on school-age entrepreneurship education and a potential global shortage of EET initiatives targeting youth outside of universities. This aligns with Global Entrepreneurship Monitor (GEM) findings that lack of EET at the school age is a key factor restraining entrepreneurship across all global geographies [80]. Particularly in fragile conditions, where attendance of universities may be considered a luxury by a majority of the population, EET (research) should shift focus to other audiences to maximize its sustainable developmental potential.

In addition, very few reviewed articles focus on alleviating poverty (SDG 1) or enhancing socioeconomic equality (SDGs 5 and 10) through targeting the relevant demographic segments. For instance, only 6 articles explicitly focus on low-income individuals, 4 articles handle programs primarily targeting women and girls and 2 articles handle minority groups (e.g., army veterans and youth with special needs). None of the reviewed articles explicitly targets victims of conflict, forcibly displaced individuals or migrants.

Although it is highly unlikely that those demographic groups are explicitly excluded from partaking in general EET programs, it is important to recognize the challenges that hinder them from participating in or benefiting from unspecialized initiatives. For example, women have been shown to exhibit some gender-specific entrepreneurial learning patterns [81], suggesting the need for personalized EET approaches for women and girls. Additionally, the psychological trauma and emotional burden facing refugees, conflict survivors, the poor and the differently abled could largely inhibit them from benefiting from generic EET approaches (see, for example, [82]). Depression alone is reported to be up to twice as common among low-income populations [83]. Therefore, researchers and practitioners are urged to focus on research on and implementation of EET specifically targeting diverse demographic groups to best position entrepreneurship as a vehicle to advance SDGs 1, 5 and 10 in advanced and fragile economies alike.

#### 4.4. Outcomes, Methods and Tools

Key education/training objectives, methods and tools discussed in the reviewed EET literature are summarized in Table 2. Most reviewed studies focus on the establishment and success of small businesses and new ventures as key desired or expected outcomes of EET, which positions EET as a vehicle to advance SDG 8. Many of those studies focus on the enhancement of entrepreneurial intention through EET, exemplified by cases in sustainable/stable economies (e.g., the USA [84], Spain [85] and the Netherlands [60]), as well as warning/alert economies (e.g., Turkey [86], Egypt [87], Iran [87] and Pakistan [61]). Others focus directly on enhancing entrepreneurial behavior such as increasing startup rate and small business success (e.g., [57,88]), while a few link EET to economic growth at a macro level (e.g., [89]). Although a few studies reveal a negative impact of EET on entrepreneurial intentions, particularly due to decreased EET participant optimism after learning exactly what it takes to start a new business [90], or that entrepreneurial intentions are not necessarily correlated with subsequent new venture creation [91], the vast majority of reviewed studies generally indicate the positive effect that EET has on enhancing entrepreneurial intention, new business formation and business success. Particularly in more fragile contexts, most reviewed studies indicate a positive correlation between EET and entrepreneurial intentions. A notable exception is a study in Pakistan [61], where the lack of progressive and experiential learning methods is blamed for a reduced entrepreneurial intention in students who attend a university EET course. This supports studies which reveal EET's particularly important positive role in countries with higher corruption and lower institutional stability levels [9]. Additionally, it is possible that EET participants in more fragile settings generally lack the enthusiasm and optimism that peers in stable economies might possess, hence do not enter the EET programs with potentially unrealistic expectations of launching the next revolutionary company compared to those in silicon-valley-like environments.

**Table 2.** Summary of EET programs by key objectives/outcomes, methods and tools relevant to advance sustainable development.

Nature of Reviewed EET Programs	All		Sustainable/Stable Countries		Warning/Alert Countries	
	#	%	#	%	#	%
<b>Key Objectives</b>						
New Business Creation and/or Growth	75	96	54	96	28	97
Innovation, Industrialization and Technology	46	59	38	68	10	34
Environmentally-Sustainable Products/Services	1	1	1	2	0	0
<b>Key Methods and Tools</b>						
Experiential Learning Approaches	50	64	41	73	11	38
Educational Technology Tools	7	9	7	13	0	0

As for studies focusing on innovation, industrialization and technological advancement as key EET objectives (SDG 9), a clear difference is observed between sustainable/stable and warning/alert countries. The majority of studies focusing on the development of innovative mindsets and problem-solving skills are based in highly stable countries (e.g., [56,69,92]), and none have been found in an alert country. This is understandable, given the higher prevalence of technology and innovation in advanced economies. However, the growth rate in mobile broadband subscriptions in least-developed countries between 2012 and 2017 was almost 55%, in addition to a 37% growth in fixed broadband subscriptions [16]. Furthermore, 15% of households in least-developed countries have access to the Internet as of 2017, while many internet users there can access the Internet from publicly available shared connections [16].

This trend could be promising for the enhancement of various aspects of innovative entrepreneurship in fragile contexts (including the use of educational technology in EET as discussed in Section 6).

Only 1 of the reviewed articles aims to explicitly advance environmental sustainability (in particular SDG 12). This unfortunately highlights a lack of scientific interest within EET research and/or practical focus of current EET efforts on stimulating eco-entrepreneurship. No surprise, therefore, that in a recent study on entrepreneurship in developing countries and SDGs, total entrepreneurship activity was found to negatively correlate with environmental sustainability measures [93]. With the global emergence of numerous innovations targeting environmentally sustainable production and consumption [19,94], EET's role in advancing those innovations could be worth investigating. Particularly in less stable parts of the world, EET could support the much-needed change of mindset that is necessary to advance eco entrepreneurship [95].

#### 4.5. EET Challenges

Several practical EET challenges were discussed in the reviewed literature pertaining to program design, delivery and evaluation. Design-related challenges include designing programs that could achieve official academic accreditation [56,96], programs particularly aiming to enhance creativity and opportunity recognition [97] and programs that enhance business growth rather than merely new business creation [98]. Delivery-related challenges result from lack of interest in or cultural resistance to entrepreneurship [58,72] and collaboration issues between key implementation stakeholders [57]. Evaluation-related challenges arise from bias in self-assessment evaluations [99], lack of measurable short-term program impacts [100] and pre-selection of students with high success potential [8].

Additional challenges related to resource availability, including lack of funding, qualified educators, learning materials and infrastructure, predominate in less-stable countries. Realizing that EET challenges differ with geographic location and country context suggests the need for higher customization of EET programs and policies. Challenges relevant to fragile contexts are further discussed in the next section.

### 5. A Closer Look: EET Challenges amid Fragility

This section zooms in on EET challenges found in countries classified in the warning or alert FSI categories per the reviewed literature. Challenges that were encountered across more than one article are highlighted and summarized in Table 3. Interestingly, all of those challenges pertain largely to resource constraints.

**Table 3.** EET challenges warning and alert countries.

#	Challenge	Country Examples	Select References
1	Limited Access to EET Facilities/Programs	Egypt, Brazil, Mozambique, Indonesia, South Africa	[63,101–104]
2	Lack of Qualified Educators	Egypt, Mozambique, Brazil, South Africa, India	[101–105]
3	Lack of Funding for EET	Egypt, Mozambique	[101,102]
4	Prevalence of Traditional Education	Ukraine, Egypt, Mozambique, Ghana, Namibia, South Africa	[67,101,102,104,106,107]

The first challenge identified was lack of access to EET facilities. This was observed across several locations, even though reasons for lack of access may differ. In the case of Egypt, EET is mostly available in some private university settings and seems to be made accessible mostly to the “elite class” of the society [101,108]. Though not specifically mentioned as a challenge in the corresponding article, a similar situation may apply to Indonesia, in which the EET program management administer psychological tests in the student selection process [63]. With mental health issues being closely

related to poverty [83], employing psychological tests in the student recruitment process could imply the exclusion of the most underprivileged from such programs. In Brazil, EET seems limited to a handful of higher education institutes and concentrated mostly in two more developed regions of the country [103]. Educational resources and support infrastructures, such as labs, libraries, and incubators appear to be quite limited in availability in Mozambique [102], restricting EET access.

Those Brazilian, Mozambican and Egyptian cases, in addition to studies in South Africa and India, also mention the lack of qualified teachers as a challenge to EET. According to the corresponding papers, the lack of trained educators in Brazil seems to be one of the biggest challenges to EET in the country, the number of teachers in Mozambique with specific training or experience in entrepreneurship as quite small, while Egypt needs to train educators on ways to enhance creativity and innovativeness in students, rather than simply transferring and assessing knowledge. The Indian case cites a lack of experienced educators and systemic focus on EET as obstacles to entrepreneurial development in the country, while teachers in South Africa appear to discourage students from disadvantaged backgrounds from taking courses focused on critical thinking (e.g., math and sciences), as they might be “too difficult” for them, hindering their development into active and effective labor market participants. Both articles on Mozambique and Egypt also mention the lack of financial resources as a main EET challenge, where lack of funding is a key reason leading to the limited availability of educational resources and support structures in Mozambique and the lack of EET in public Egyptian universities.

Egypt, Mozambique, Ukraine, Ghana, South Africa and Namibia also seem to have a prevalent culture of traditional education in which innovative curricula and teaching materials are lacking. Egypt has a traditional public education system where habitual memorization of standard learning materials largely prevails over fostering practical knowledge and creative thinking. Ukrainian teachers use Russian and Ukrainian textbooks, which do not incorporate recent global advances and current methods in EET as main knowledge sources. Students in Ghana report very little focus on developing practical knowledge and skills through the EET they receive and teachers indicate the use of untailored foreign curricula as a challenge to students. Namibian students have such little exposure to progressive education that they may feel insecure when entering an innovative learning environment. Finally, the South African education system has been criticized for its poor preparation of young learners for future entrepreneurial careers and business skills due to focus on traditional learning methods.

Interestingly, several of those challenges may also apply to general academic education. For instance, a study in Nigeria indicated that the lack of infrastructure and learning facilities, public financing, inadequacy of academic staff and defective curricula are challenges facing higher education [109]. In Haiti, 80% of primary schools are private, and hence cannot be afforded by the poorer families, in addition to a shortage of trained academic staff and schooling infrastructure [110]. Poverty constricts access to schooling in Mexico, Malawi, Kenya and Colombia, while distance to school lessens enrollment of Afghans, particularly girls, in school [13]. Teachers were often found absent in schools in Bangladesh, Ecuador, India, Indonesia, Peru and Uganda, while textbooks seem to be tailored only to the best performing students in Kenya [13]. Although the nature of general academic education and EET may differ, one may imply that some solutions to general academic education challenges in less-stable countries may also apply to EET.

## 6. Tackling the Challenges: The Promise of Technology

Adaptive and intelligent technologies, though not entirely new [111–113], have only recently become an (increasingly-) important part of debates concerning enhancing education in challenged environments (see for example [114]). Currently, though, such educational technologies range from simple innovations such as Cybersmart Africa’s use of PVC pipes, nylon sheets and Nintendo Wii remote controls to create interactive whiteboards in Senegalese schools [115], to complex ones combining various modern technologies to produce advanced educational software (see for example cases from Morocco [116] and Taiwan [117]).

A prominent example of currently widespread educational technologies is Massive Open Online Courses (MOOCs), essentially online courses that allow anyone anywhere to register and access educational content (usually) without paying fees. Though generally seen as a potential solution to lack of educational materials, instructors and academic institutes in developing and fragile countries [118,119], MOOCs do not necessarily foster the collaboration, adaptation and experiential needs of effective entrepreneurial learning. On the other hand, several experiential and collaborative learning technologies such as augmented reality [120,121] and wearable technologies [122] might be difficult to implement in low-resources environments due to high cost and hardware maintenance needs.

Nevertheless, there exist several software-based solutions that have the ability to enhance creative thinking, collaboration and problem-solving while mitigating specific fragility-related challenges facing entrepreneurship education. Important examples are intelligent-tutoring systems (ITS), mobile applications and simulation games built on foundations of machine learning, artificial intelligence, gaming and mobile app development, among other technologies. Such technologies could have the capability to enhance personalization, collaboration, engagement in and access to learning [15], while addressing educational challenges such as shortage of qualified teachers and lack of innovative educational materials, especially with their current availability in developing countries, both home-grown (developed by local researchers) and designed elsewhere [14]. Below are some specific examples of successful educational technology implementations in alert and warning countries, identified through reviews of educational technology literature, that could inspire adaptive learning system development and adoption for EET in the fragile context. It is worth mentioning that searching through multiple databases, both mainstream and scientific, has yielded no results for case studies explicitly featuring implementation of adaptive educational technology in EET.

- Example 1—Ghana and Zambia [123].

The use of an automated reading tutor, LISTEN, was piloted in Ghana and Zambia, through which children who struggle in learning the English language learn through a personalized tutor. The tutor listens to the child as they read stories displayed on the computer screen, analyzes the reading, and provides graphical and spoken feedback. Learning progress is monitored, and stories are displayed at a level appropriate to the child's. In Ghana, this was piloted in an internet café near a school, where only one computer was needed, which the children took turns to use. The system could potentially include learning content adapted to the local culture and dialect.

The tutor was also tested on Ghanaian children from a public school in a low-income community as well as others enrolled in an informal educational program for disadvantaged children and results provide evidence that students who used the tutor gain considerably more knowledge than others. It might also be worth mentioning that students received only minimal training in computer use before using the software, and the system was often used by multiple children at a time, who would help each other in their learning process. The system was then also tested in a Zambian school that contained a computer lab and showed promising results.

- Example 2—Brazil [124].

Realizing the plentitude of online-available educational resources and materials combined with a need for virtual teachers and independent student learning, Edukas was developed as “a learning environment, a management system and an analytics framework” ([124], p. 12). The system uses data mining techniques to analyze each student's level and behavior and therefore suggest/predict learning materials that fit them the most. Therefore, the students receive personalized learning content from a large database. Teachers are also able to use the system to assess the students' performance and define action strategies and roadmaps that enhance their decision-making capabilities.

- Example 3—India [125].

The use of computer games aiming at enhancing mathematics skills was implemented in schools across Gujarat, where games were adjusted to each student's level so each can learn at their own pace. This approach had a significant impact on increasing test scores, presumably as each student is self-stimulated independently from their own achievement level, particularly in communities where students face negative social attitudes and prejudices. Such programs also appear to be inexpensive and easy to scale.

- Example 4—Mexico [126].

EDUCA, an e-learning content development software, was developed to allow trainers and educators to create a variety of courses, such as Introduction to Computer Science and Maya Language. This tool allows a main instructor to create a virtual tutor using a variety of multimedia methods such as video and images and define learning styles, tags, pre-requisites and quizzes. At a later stage, learners themselves are able to add additional resources to the system. The software is then exported to a mobile format, enabling students to access content from mobile devices. Specific prerequisites and learning styles generate a personalized learning pathway for each student. The result is an intelligent tutor that enables learning without the need for an external teacher and can be accessed remotely using a mobile device.

- Example 5—Thailand and Pakistan [127].

A tutoring system was developed to assign medical solutions to patient problems to aid medical students in their learning process. The system allows students to find flexible and creative acceptable solutions to several medical scenarios and helps them find solutions to complex problems that might not have a single correct answer. The system has the potential to evaluate the plausibility of the solutions created by the students and has received positive feedback when tested in two medical schools in Thailand and Pakistan.

- Example 6—China [14,128].

AutoTutor, an Intelligent Tutoring System ITS that has been implemented across multiple learning domains, including computer literacy, physics, and critical thinking, simulates a human tutor by holding a conversation with the learner in natural language. The dialogue is amplified through an animated conversational agent and three-dimensional interactive simulations to enhance learning engagement and depth. AutoTutor has been shown to significantly increase learning gains and appeared indistinguishable from a human tutor during system testing. With China's poor, rural and migrant residents being challenged by lack of access to quality education, especially with qualified teachers migrating to urban areas, the use of such ITS fits into the Chinese government strategies of developing and adopting online and digital educational technology to enhance educational outcomes across the country [129].

- Example 7—Pakistan [130].

Baghecha-e-Ism (BISM), an android mobile application, was developed as an educational game to support 4th graders in learning Urdu grammar. The app contains audiovisual content that was designed to better capture learners' attention while an automated content generator produces learning materials suitable for the learner's level following specific content authoring rules. The app also computes and stores analyses of each learner's progress to support evaluating and monitoring the learning process. The use of the game in Pakistani schools has been shown to yield significant improvements in knowledge acquisition and produce additional inadvertent positive results, such as enhanced collaboration between students and increased engagement and joy.

As seen in the above cases, educational technology could enhance learning even in low-resource environments among populations with low literacy levels and in school ages, such as the examples of Ghana/Zambia, Pakistan and India. In addition, the Mexico and Pakistan examples demonstrate the ability to develop and use educational technology on mobile devices, which is encouraging given the rise in mobile device adoption in least developed countries even where personal computers might not be widely available. The cases of Thailand/Pakistan and China could inspire the development of a software that aids learners in assigning viable, creative solutions to various business problems, where no one right answer might exist, in a dynamic and interactive environment. The Brazilian example also shows how adaptive learning content and effective monitoring and evaluation can be combined in one system. What those examples demonstrate is how technology can address the lack of qualified educators and educational resources such as books or libraries, while often allowing access to education from home or a mobile device at low or no cost to the student, particularly where funding for education is lacking, with the added value of personalization of learning and increased student engagement and collaboration.

In addition, technology-enabled learning environments can be aware of the learners' prior knowledge, skills and abilities and record and track different learning patterns among student groups (e.g., males versus females) as well as successful versus unsuccessful means of collaboration among students [15]. This could thus assist in assessing individual learning, for instance through evaluating input to quizzes and interactive exercises, as well as comparing, monitoring and evaluating different learning strategies [15]. Data collected and analyzed through software applications could also include administrative data (e.g., school district, teacher) and demographic data (e.g., student age, gender, school grades), which may allow for researching, analyzing and advancing learning tools [15].

## 7. Conclusions and Limitations

In the face of global fragility, social inequality and (youth) unemployment, entrepreneurship could be key for sustainable socioeconomic empowerment. However, this is difficult to achieve without education that employs the proper methods, tools and objectives and equally targets all society segments. Therefore, this paper sought to deepen our understanding of EET in the sustainable development context, shed light on associated challenges and better comprehend technology's role as a potential mitigation.

The study has several contributions and implications. From a theoretical standpoint, it represents one of the first analyses of entrepreneurship education in the sustainable development context and provides a unique framework to analyze the relationship of EET with respect to the advancement of specific SDGs. Additionally, it targets little-addressed research gaps on fragile-country entrepreneurship, particularly in the EET context, and provides a unique analysis of EET challenges amid fragility. Moreover, this paper blends insights from the EET, sustainable development and educational technology literature streams – ones that have rarely been combined in previous studies. This research therefore sets the stage for future empirical analyses on EET's contribution to SDGs, EET challenges in fragile contexts and technology's contribution to resolving those challenges.

The study reveals a shortage of EET research outside of stable western countries and university walls, with little focus on environmental sustainability and innovative entrepreneurship particularly in less-stable countries. Additionally, the reviewed articles seldom mentioned low-income groups, women or minorities, with no research found on EET targeting conflict-affected individuals or migrants. This could be due to the fact that researchers are often incentivized to merely publish their work rather than focus on the social or environmental implications of their research [52,131], which calls for institutional reforms that encourage scholars to pursue meaning and relevance in their research endeavors.

Accordingly, several specific recommendations may be made for future research. Firstly, although entrepreneurship education research has been growing in major entrepreneurship journals, there is a clear need for a shift in direction if entrepreneurship education research is to reach its full potential with respect to supporting sustainable development. This includes an increase in the quantity of

research featuring EET programs that are non-university-based, located outside of institutionally stable countries and/or targeting demographic groups that are not adequately represented in entrepreneurship scholarship (see also Welter et al.'s call to diversify entrepreneurship research [53]). For instance, a myriad of EET initiatives have been recently established in fragile countries to enhance employability and entrepreneurial knowledge for unemployed adults and school-aged youth. Such initiatives remain under-studied by entrepreneurship scholars or at least highly underrepresented in highly ranked entrepreneurship journals. A few examples include YES Network Pakistan, IFAD's PROSPERER in Madagascar and Botswana's Kickstart in addition to global initiatives such as the ILO's Know About Business and the UNCTAD's Empretec [132]. Similar initiatives should be key sampling and case study targets for EET research if it were to enhance focus on advancing sustainability.

A shift in the quality of EET research is also needed. It is recommended to focus on research pertaining to the desired outcomes of EET with relation to sustainable development. For example, Moon et al. [133] point out the importance of building a socially and ecologically aware mindset for learners and teachers alike to maximize the sustainable impact of EET in higher education institutes. Although a large number of studies focus on mindset development as key EET outcome (for example [68,69,134,135]), very few focus on EET's relationship to developing the mindset needed to achieve sustainability through entrepreneurship. Additionally, I follow Schaltegger et al. [136] in recommending additional research on the role of collaboration in achieving sustainable development through entrepreneurship, with a specific focus on EET's impact on fostering collaborative mechanisms among and within entrepreneurial ventures and teams to enhance sustainability. Finally, the success of EET programs remains largely evaluated from an economic perspective (e.g., number of startups established, financial performance of resulting firms, etc.) rather than a social or environmental perspective [137]. These evaluation approaches are rather insufficient to evaluate EET's contribution to sustainable development. It is, therefore, recommended to perform research evaluating EET based on impact on critical thinking skills [138] and competencies [139] needed to achieve sustainable development, as well as using evaluation tools particularly tailored towards measuring sustainable impact [140].

Additionally, further research is recommended on macrolevel factors that influence EET's contribution to SDGs. For instance, studies show that additional workload on instructors [70] and cultural resistance [71,108] are among the reasons that hinder entrepreneurship educators from using experiential learning methods, but few studies focus on how resource constraints, national culture or religion contribute to these issues. Additionally, the impact of entrepreneurship policies, funding allocations and donor strategies on EET program design and outcomes with respect to sustainability are worth investigating.

In addition to pinpointing areas of improvement for current EET research to better target SDG advancement, the findings have several implications for EET practitioners. Firstly, the study identifies several areas where EET initiatives ought to shift focus. For instance, more programs that are particularly inclusive to women, ethnic minorities, differently abled individuals and the low-income need to be established. This could be supported through the involvement of those target beneficiary groups in the design and management of EET programs. The inclusion of EET in public school curricula worldwide also needs to be considered. Moreover, EET programs need not simply focus on starting a business as an end result, rather on building the mindsets and skills to create ecologically and socially responsible future products and services.

Additionally, the paper sheds light on the unique challenges that education and research face in fragile countries—namely, the shortage of funding and qualified teachers, prevalence of traditional education methods and poor access to EET—calling for alternative mechanisms through which EET implementation and research can be optimized. Alternative financing mechanisms and teacher training approaches, particularly to build an experiential learning culture and sustainability mindset within educators, might be particularly worth considering in fragile settings.



Technology-based EET is proposed as a possible mitigation to the challenges in fragile contexts, as several educational technologies do not only allow for the personalized, collaborative learning needed for entrepreneurial skill and mindset development, but could potentially tackle specific education challenges such as lack of access to learning centers, qualified educators and innovative teaching materials in the absence of sufficient financial resources. In addition, such technologies provide alternative research avenues by easing some of the barriers associated with conducting research in alert and warning countries. Future research evaluating how various technological tools and approaches could be best implemented in EET is needed in addition to research focusing on using educational technology as means to research and evaluate EET initiatives. Moreover, practitioners are invited to experiment with implementing such technologies in EET, drawing on learnings from other educational contexts.

Undoubtedly, findings from this study are not conclusive, and are dependent on the literature search criteria used in this systematic review. For example, literature from development economics, pedagogical sciences and computer science has not been explicitly included in the main review conducted in this paper. In addition, alert and warning countries are not all the same and each has unique characteristics and challenges that need to be carefully evaluated and considered when formulating solutions. This article simply aims to emphasize some of these challenges to open the door for contemplation and future investigation.

Finally, technology alone cannot be considered a magic problem solver. The success of using technology to tackle education challenges highly depends on technology customization to local culture and traditions, whether proper analysis of local needs was performed, availability of adequate technical maintenance and the provision of local guidance on technology use [141]. In addition, issues such as poor infrastructure (e.g., electricity, internet or hardware availability) and the enforcement of local political regulations on learning content need to be considered [14]. This calls for proper communication and alignment between technology developers, sponsors, end-users and host governments [14], as well as thorough analysis and understanding of local environments. Leveraging on-the-ground resources, such as civil society organizations, activists and community leaders could prove valuable in those circumstances.

**Funding:** I acknowledge support by the German Research Foundation and the Open Access Publication Fund of TU Berlin.

**Acknowledgments:** I would like to thank my PhD supervisor, Jan Kratzer, for his continuous support. Special thanks also go to Clemens Möckel for the inspiring conversations and scientific discussions.

**Conflicts of Interest:** The author declares no conflict of interest.

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