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ORIGINAL PAPER

Built to last? The long-term impact of entrepreneurship education on entrepreneurial attitude

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Abstract

A high rate of youth unemployment is one of the toughest problems facing African countries and which threatens the attainment of the sustainable development goals. Entrepreneurship education interventions are thought to be helpful in creating entrepreneurs whose activity will ultimately help to reduce the burden of youth unemployment. However, do such interventions work consistently in the long term? Drawing upon the theory of planned behaviour and a new typology of impacts, we tackle this question in the context of a long-standing entrepreneurship education intervention in Nigeria. We use pooled cross-sectional data from a sample of over 12,000 Nigerian undergraduates and apply an instrumental variable approach in a difference-in-differences (DiD) regression framework to obtain intention-to-treat estimates, thereby avoiding overoptimistic estimates of impact. The results show that despite a strong positive instantaneous impact, the longer the policy has been in place, the weaker its effect. In real life, it means that the policy is unable to continue to generate the desired impact of increased interest in entrepreneurship among repeated student cohorts, all else being equal. We suggest ways to overcome the inconsistency of impact and drive long-term social change; these include differentiating entrepreneurship curriculum to match students' pre-course profiles. Overall, our study provides the first long-term impact evaluation of an entrepreneurship education intervention in a developing country context. Thus, we advance the policy debate on how to design and implement effective entrepreneurship education interventions that can foster youth entrepreneurship and employment.

Keywords Entrepreneurship education · Decent employment · Impact evaluation · Difference-in-differences · Nigeria · Universities

Extended author information available on the last page of the article

Introduction

The global labour market is characterised by a high rate of youth unemployment, much higher than total unemployment rate particularly in middle-income countries (Fig. 1). In Nigeria, the latest figures from the National Bureau of Statistics (NBS, 2021) show a youth unemployment rate of 43% at the end of 2020, 10 percentage points higher than the rate of unemployment in the entire population. In this context, interventions to promote youth entrepreneurship are thought to be useful. Youth entrepreneurs create jobs for themselves and others, thereby reducing the aggregate burden of unemployment (Van Praag & Versloot, 2007; Wennekers & Thurik, 1999; Nelson, 1977). Entrepreneurship education, often delivered through universities to gain access to large youth populations, is one of the most common interventions aimed at increasing the rate of youth entrepreneurship. For this reason, university-level entrepreneurship courses are becoming increasingly popular in developing countries, especially in Africa (Mbeteh and Pellegrini, 2018). It is believed that such university entrepreneurship interventions play an important role in raising the next generations of potential entrepreneurs from among the university students (Maresch et al., 2016; Mok, 2005; Olofinyehun et al., 2018; Oosterbeek et al., 2010).

However, there are at least two critical gaps in the literature. First, evaluations of entrepreneurship interventions in developing countries focus on market-based programmes such as business plan competitions (McKenzie, 2017), grants to existing businesses (Blattman et al., 2014; Karlan et al., 2015) and business training programmes (Mano et al., 2012; McKenzie & Woodruff, 2014). The existing literature on the effects of university-level entrepreneurship education programmes is disproportionately focused on developed economies (for instance Eesley et al., 2016; Hsu et al., 2007; Oosterbeek et al., 2010; Rothaermel et al., 2007; Shneor et al., 2021; Von Graevenitz et al., 2010). Thus, there is a chronic deficit of evidence on the impacts of university entrepreneurship education interventions in the global South. The few studies in Africa are descriptive in nature and offer limited insight

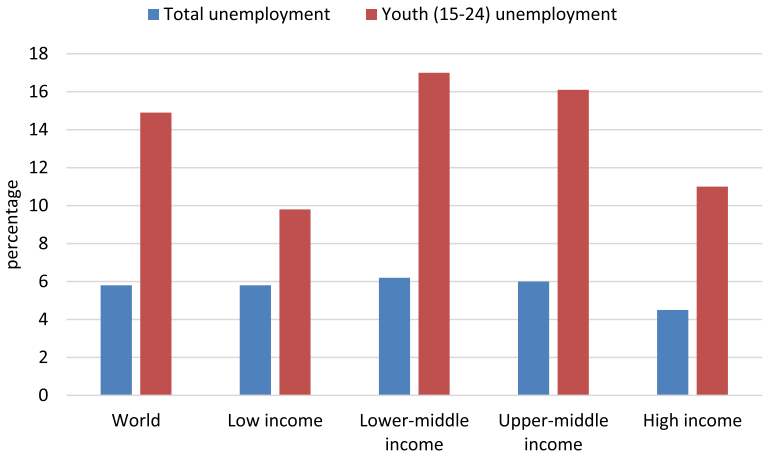

Fig. 1 Unemployment rates by country income grouping. ILO, 2023 Source:

on whether these programmes are working or not, except for rare exceptions like Olofinyehun et al (2018). Given the potential misfit between received theory and the realities of developing countries, entrepreneurship policy in the global South will benefit significantly from more rigorous empirical evidence that is contextually relevant. Second, the literature on the impact of entrepreneurship education has recently begun to shift away from its focus on students' entrepreneurial orientation to post-graduation entrepreneurial outcomes (see, for instance, Eesley and Lee, 2021).[1] In a sense, this shift permits a long-term approach to impact evaluation of entrepreneurship education interventions, but it leaves unanswered the question of whether the impact of these interventions remains consistent over time. Specifically, how does an education intervention affect different groups of students over time? For example, if an intervention increased entrepreneurial orientation in a cohort of students last year, will it achieve the same in a new student cohort this year, other things being equal? Answering this question will help to remove guesswork from entrepreneurship education interventions. It will also help to ensure that entrepreneurship education achieve their primary aim, that is, to foster long-term social change.

This study contributes to the literature by filling the identified gaps. Ensuring that entrepreneurship education interventions consistently deliver a positive impact across different cohorts is an important real-life policy concern, especially given that such interventions last for a long time, with different student cohorts exposed to them. This study offers relevant insight from the first long-term impact evaluation of an entrepreneurship education intervention in Nigeria, a typical developing country with a high youth unemployment burden. The intervention, which was initiated by the National Universities Commission (NUC) in 2006, consisted of a compulsory elective course in entrepreneurship that must be taken by all undergraduates regardless of their discipline, and the establishment of an entrepreneurship development centre (EDC) in all Nigerian universities. Our analysis focuses on the education component of this intervention, and we examine how its impact varies over time. To do this, we rely on data from four surveys of undergraduates across six Nigerian universities. The surveys were repeated every 4–5 years from 2007 to 2021.

In the rest of this paper, we first present a review of empirical evidence on how entrepreneurship education may motivate a preference for entrepreneurship among young people. We then develop a conceptual framework that incorporates four different types of impact that an intervention may have—instantaneous, persistent, consistent and cumulative. We illustrate with examples from the literature how each type of impact is measured and explain how each one is relevant for policy. This is followed by our analysis of the consistent impact of the NUC intervention on the entrepreneurship interest of undergraduates in six of Nigeria's largest universities. To deal with endogeneity, we use a difference-in-differences approach in an instrumental variable setting. In particular, we exploit the fact that the intervention was not implemented by the universities at the same time, and that only students in a

[1] The limited research on the impact of entrepreneurship education on entrepreneurial orientation still lags behind (Yatu et al., 2018). This leaves room for more empirical impact evaluation studies that link entrepreneurship education and students' entrepreneurial intentions.

university where the course was already offered could be affected by it. Our results show that the rate of entrepreneurial interest among the undergraduates declined significantly in the absence of the intervention. In addition, the longer the intervention had been in place, the less effect it seems to have on entrepreneurial interest among student cohorts. These findings raise the need for policy innovations, of which we suggest three.

Theoretical background

This paper builds upon an earlier one (Olofinyehun et al., 2018) that evaluated, for the first time ever, the immediate impact of the NUC's entrepreneurship intervention. In a difference-in-differences framework, the paper compared entrepreneurial interest in randomly selected cohorts of undergraduates across three universities that had implemented the policy (treated sample) with cohorts across three universities that had not yet implemented the policy in 2011 (untreated sample). It found a strong positive impact of compulsory entrepreneurship education on the interest of young persons to start their own business, even when individual attributes are considered. However, the level of interest in entrepreneurship was unaffected. The conclusion from these results was that entrepreneurship education curriculum needs to be adaptive because the content that elicits entrepreneurial interest is apparently incapable of reinforcing it. In other words, if the profiles of students were well understood, the curriculum content offered to those already interested in running their own businesses should differ from the content presented to the uninterested ones.

In the current paper, our aim is to re-evaluate the long-term impact of the compulsory entrepreneurship education intervention. Our focus is on whether the intervention is able to consistently deliver a positive impact as student cohorts come and go. This is an important real-life policy concern but one that has been ignored in previous research. To set up the analysis, we first review the literature on the link between entrepreneurship education and attitudes. We then distinguish between four types of policy impact that are relevant to policymakers.

The link between entrepreneurship education and entrepreneurial attitudes

The theory of planned behaviour (Ajzen, 1991) suggests that a behaviour is driven by three important psychological properties, including attitude towards the behaviour, subjective norms and perceived behavioural control. According to the theory, entrepreneurship behaviour occurs based on the degree to which an individual considers entrepreneurship as a favourable outcome. Subjective norms relate to the acceptability of the behaviours in the society. For instance, if an individual believes that an entrepreneurial undertaking is acceptable in a particular setting, say, among peers, friends and society, there is a high probability of engaging in it than otherwise. The third component, perceived behavioural control, relates to the capability of an individual to actually exercise the behaviour. In this case, competence and context matter (Lamine et al., 2021; Yami et al.,

2021). To promote entrepreneurship among university students and to provide an adequate entrepreneurship education programme that can guarantee positive business outcomes, it is imperative to understand the students' initial drive and motivation for participation in the education programme (Ndofirepi, 2020). Moreover, entrepreneurship education needs to consider students' background. For instance, it has been argued that the effect of entrepreneurship education on entrepreneurial intention does not happen uniformly in all contexts since different contexts may require different action (Núñez and Morales-Alonso, 2024). Specifically, some studies have highlighted that entrepreneurship education addresses subjective norms separately for students in different disciplines (Lamine et al., 2021; Maresch et al., 2016).

The overarching role of entrepreneurship education as a mediator of attitude, subjective norms and perceived behavioural control is well-documented in the literature (Frese et al., 2016). By exposing an individual to entrepreneurship education, their attitude, perception and aspirations towards entrepreneurship receive a boost (Ripollés & Blesa, 2023; Boldureanu et al., 2020; Díaz-García et al., 2015; Rauch and Hulsink, 2015; Regele and Neck, 2012). This notion is consistent with the human capital theory, where education is believed to imbue skills and knowledge into individuals to enhance competence and capability for independent or collective action (Becker, 2009). Studies have consistently demonstrated that entrepreneurship education has the potential to spur an interest in entrepreneurship among young individuals (Shneor et al., 2021; Liñán and Fayolle, 2015; Valerio et al. 2014; European Commission 2012). Siyanbola et al. (2012) showed that exposure to entrepreneurship education improves interest in entrepreneurship among university undergraduates in Nigeria. Also, Maresch et al (2016) establish that entrepreneurship education helps to address the issue of subjective norms, especially when modified to suit the target groups.

In addition to interest, entrepreneurship education also tends to increase participants' awareness of entrepreneurial opportunities and helps them to develop relevant skills for new venture creation (Martínez-Gregorio et al., 2021). Moreover, existing research shows that even if entrepreneurship education does not directly achieve the aim of creating more entrepreneurs, it could help in filtering out low-potential individuals (Slavtchev et al., 2012). This is because it allows participants to self-discover their entrepreneurial potential and to make a more accurate assessment of their ability to engage in entrepreneurship in the future (Morland et al., 2021; Ndofirepi, 2020). In other words, as Bergmann et al. (2018) found in their study of over 8000 students in German universities, entrepreneurship curriculum content seems to "initiate a social process of sensemaking". On the one hand, entrepreneurship education could "sort" students towards entrepreneurship by providing relevant and encouraging information to those who are initially undecided about their interest. On the other hand, entrepreneurship education helps to "align" interests by helping the overly optimistic or pessimistic students update their beliefs (Fretschner & Lampe, 2019). This supports the notion that the impact of entrepreneurship education may be enhanced by understanding the prior profile of students and adapting curriculum content to their needs.

It has been suggested that entrepreneurship education needs to have certain attributes for it to be effective. For instance, experiential entrepreneurship education is important for individuals interested in starting business ventures, as it fills the gaps between knowledge acquisition and tacit appreciation of what it takes to be entrepreneurial (Morland et al., 2021; Valencia-Arias et al., 2021). Della Volpe (2020) argues that entrepreneurship education that will equip the twenty-first century entrepreneurs with skills and mindsets for business creation should go beyond the traditional classroom teaching to incorporate knowledge that promotes innovation. Thus, designing and delivering an experiential programme requires, among other things, aligning the entrepreneurship curriculum with industry needs, providing students with practical exposure, and creating opportunities for interactions between students and practicing entrepreneurs (Walter et al., 2013; Guerrero and Urbano, 2012). Other authors have also suggested role modelling (Van Auken et al., 2006; Karimi et al., 2013), case studies (Byabashaija and Katono, 2011), and mentorship (Karimi et al., 2013) as effective components of an experiential entrepreneurship programme. Furthermore, entrepreneurship education is most effective in the context of a favourable ecosystem featuring, for instance, university-based incubators and seed funding, to facilitate the translation of training-induced skills, perceptions and intentions into action (Valencia-Arias et al., 2021). Indeed, recent evidence (Radko et al., 2023) suggests that businesses launched inside a university-located incubator have higher chances to succeed.

From the review so far, we can infer that considerable evidence exists on the benefits of entrepreneurship education and how effective entrepreneurship education interventions should be designed. However, but for a few exceptions, the literature is confined to developed countries. Moreover, most existing studies, even when they undertake rigorous impact evaluations of entrepreneurship education interventions, concentrate on the short term. The question of whether an intervention could remain impactful in the long run, especially as different student cohorts are exposed to it, remains unanswered. In the next section, we draw on the impact evaluation literature to identify different types of impact that correspond to different research questions, including the one we address in this paper.

A typology of impact

Understanding when and how policies and interventions work has been the subject of much research. Although there are different methods of evaluation, randomised control trials (RCTs) are viewed as the most reliable (Duflo et al., 2007). Nonetheless, RCTs are not always possible for several reasons. For instance, the nature of an intervention (such as the entrepreneurship education intervention that we study in this paper) may not permit randomised allocation of participants without ethical violations. In such cases, impact evaluation may be carried out based on observational data, in a quasi-experimental setup where assignment to treatment is not random. As we do in this paper, a control group can be readily constructed if the intervention does not affect the entire population at the same time (Bernard, 2012). Quasi-experimental studies within context are more relevant for policy than experimental

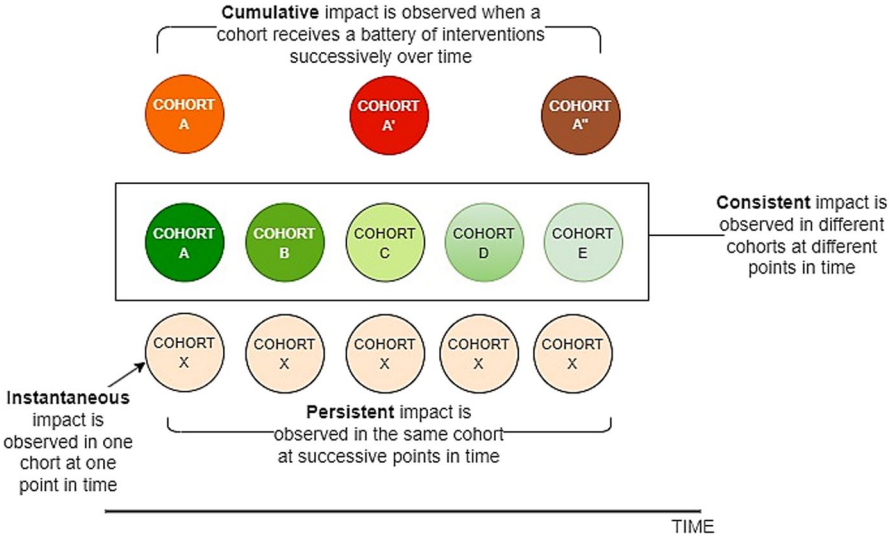

Fig. 2 Four different types of impact

studies from another context, despite being often criticised for their tendency to over-estimate impact (Bayer et al., 2020; Pritchett & Sandefur, 2015). Therefore, the evidence generated in our analysis is more relevant for policymaking in the global South than experimental results from elsewhere.

Irrespective of the method, impact evaluations exploit intertemporal variations in the outcomes of interest (McKenzie, 2012). For instance, in this paper, we are interested in how the entrepreneurial interest of students changed over time within the cohort of students who were exposed to the intervention compared to those who were not. Based on the intertemporal nature of impact evaluations, we distinguish four types of impact that may be of interest to practitioners and policymakers (Fig. 2). We also make the case for the novelty of our work.

i. **Proximate impact** refers to the impact of an intervention on a cohort[2] of participants over a short time horizon. Measuring this impact typically involves comparing two groups, the treatment and control, shortly after the intervention. The study by Shankar et al (2015) illustrates proximate impact. It evaluated eight months post-intervention, the impact of a 4-day empowerment training (compared to an entrepreneurship training) on business sales of Kenyan male and female entrepreneurs. Similarly, Bruhn and Zia (2013) evaluated around six-month post-intervention, the impact of a business and financial literacy training on firm outcomes in Bosnia and Herzegovina. For several reasons, a large share of the impact evaluation literature focuses on instantaneous impact.

[2] We use the term *cohort* to describe the whole sample within which impact is being measured. The cohort is split into two basic *groups*, the treatment group and the control group.

For example, a large family of interventions in entrepreneurship (e.g. business plan competitions, cash transfer, etc.) are one-off or active over a short time horizon. Intervention and data collection costs may be too prohibitive to permit the maintenance of an intervention or its evaluation over the long term. Also, it may suffice for the policy question at hand to demonstrate as soon as possible whether an intervention is working.

ii. **Persistent impact** is obtained from repeated measurements of an intervention's impact on one cohort over a medium or long period. Usually this involves comparing the same treatment and control groups at least twice after the baseline to see whether the instantaneous impact persists. This is especially suited for interventions that are expected to have long-lasting effects, such as business training for entrepreneurs and the adoption of new business practices. An example of this is the study by McKenzie (2017) which showed that grants provided to winners of a business plan competition in Nigeria led to greater firm entry, more survival, higher profits and sales, and higher employment. The impact was measured annually until four years after baseline. Another example is the evaluation by Bulte et al. (2017) of the effects of gender and business trainings provided to poor women in Vietnam. The monthly training continued for nine consecutive months, with the possibility of repetition. The study assessed the impact of the intervention on business practices, sales and profits 8 months after baseline and again 23 months after. The two intertemporal effects were compared to see whether they taper off or increase over time. Also, Brooks et al. (2018) found that assigning a mentor to young businesses impacted profits in the short run but the impact fades over time.

iii. **Cumulative impact** becomes relevant where a cohort is exposed to a battery of interventions, often in sequence. The aim of cumulative impact evaluation is to estimate the additional impact of later interventions to earlier ones. Most policy innovations fall under this category. For example, the RCT by Adeyeye et al. (2022) evaluated the cumulative impact of an apprenticeship training and a bi-weekly SMS nudge on new business formation among young graduates in Nigeria. In three Central American countries, Klinger and Schündeln (2011) evaluated the effects of business grants on the formation or expansion of businesses by individuals who received business training and were successful in a proposal competition. Similarly, Berge et al. (2015) evaluated the impact of a combination of two interventions—business training and business grant—on business performance and management practices, among others.

iv. **Consistent impact** describes the effect of an intervention on different cohorts that encounter it at different times. Usually this involves comparing two groups within a cohort at a particular time, and then repeating this process in a different cohort at a later time. In many real-life scenarios, especially in the context of higher education, an intervention or policy remains in place while cohorts change over time. Such intervention is only meaningful in the long term if it can repeatedly generate the desired effects on the changing cohorts. To the best of our knowledge, no studies exist that perfectly examine consistent impact of

entrepreneurship or enterprise development interventions.[3] Thus, our evaluation in this paper, which relies on four surveys of different cohorts exposed to the same entrepreneurship education intervention, represents a pioneering effort. We examine the consistency of the intervention's impact every 4–5 years during the 14 years between 2007 and 2021.

Empirical context, data and methods

Intervention and context

The National Universities Commission (NUC) regulates the university system on behalf of the Nigerian government. Like the demand for university education, the number of universities in Nigeria has grown significantly since the early 2000s. For instance, around 1 million candidates competed for admission into about 150,000 places in 52 universities in 2002 (Okebukola, 2006). By 2019, there were nearly 2 million applicants for less than 800,000 admission places offered in 170 universities (NUC, 2019). Completion rates are high, implying a large demand for scarce postgraduate employment opportunities. In the light of this, the NUC introduced a public policy intervention in 2006 that mandated the inclusion of compulsory entrepreneurship courses across all university undergraduate programmes.[4] Until this intervention, most universities offered courses related to entrepreneurship only in a few disciplines such as business management. Students in other disciplines receive little to no exposure to entrepreneurship education. The aim of the intervention was to encourage an entrepreneurial mindset in students, with a view to increasing the pool of potential highly educated entrepreneurs. It is believed that highly educated entrepreneurs have a disproportionately high propensity to create and manage growth-oriented firms (Gennaioli et al., 2013).

In most universities, the compulsory entrepreneurship course is categorised as a one-semester mandatory elective for undergraduate students, typically scheduled between their second and final years of study. Consequently, once an individual is enrolled in a university where this policy is in effect, they are obliged to successfully complete the compulsory entrepreneurship course before concluding their regular academic program. The implementation of this policy commenced around 2007; however, the exact timing varied among universities, with some universities adopting the policy earlier than others. This staggered implementation schedule provides a unique opportunity to employ a difference-in-differences (DiD) framework, leveraging the variation in the implementation dates across universities, in order to evaluate the impact of the policy.

[3] We searched the world's largest impact evaluation databases, including the 3ie database of impact evaluations and systematic reviews, among others. The study by Klinger and Schündeln (2011) tests for consistency of impacts but only in terms of geography and gender, not in intertemporal terms.

[4] Additionally, entrepreneurship development centres (EDCs) were established as part of this initiative.

Table 1 Details on the entrepreneurship surveys

Name of institution	Year of policy implementation	Sample				
		2007	2011	2016	2021	Total
University of Lagos, Akoka	2005/2006	371	821	507	665	2,364
Covenant University, Ota	2002	281	344	534	744	1,903
Obafemi Awolowo University, Ile-Ife	2007	360	641	583	646	2,230
Total treatment group		1,012	1,806	1,624	2,055	6,497
Federal University of Agriculture, Abeokuta	2011	301	17	562	521	1,401
Federal University of Technology, Minna	2011	79	954	500	623	2,156
Ahmadu Bello University, Zaria	2011	357	964	591	649	2,561
Total control group		737	1,935	1,653	1,793	6,118

Data

Our data come from four repeated cross-sectional surveys from a set of six universities where undergraduates (excluding freshmen) were randomly sampled in 2007, 2011, 2016 and 2021 (Olofinyehun et al., 2022).[5] The data are thus longitudinal at the university level but cross-sectional at the individual level. Nonetheless, the large size and long duration overcomes the data limitations common to many entrepreneurship studies (e.g. oosterbeek et al., 2010; Ripollés & Blesa, 2023). Table 1 describes the sample distribution. In total, the pooled sample includes 12,615 undergraduates, about half of whom are from universities that started the intervention by the time of our first survey in 2007 (the treatment group). The rest are from universities that started the intervention after the second survey in 2011 (the control group). The data structure allows us to evaluate intertemporal variation in the impact of the intervention at individual level in different undergraduate cohorts. This effect is what we characterise as consistent impact. In an ideal setting with individual-level longitudinal data, the evaluation from 2016 onwards would compare the treatment and control groups in terms of how long they have been exposed to the intervention. However, in our setting with pooled cross-sectional data, it shows whether the intervention exhibits a consistent impact on different cohorts at different points in time. In other words, the observed effect reflects the long-term impact of the intervention in the universities where it was implemented before 2011 relative to the ones where it was implemented after 2011.

Variables

There are two outcomes of interest. The first one, entrepreneurial interest (EI), measures an individual's interest in starting their own business. It is measured by the binary response to the survey question, "Are you interested in starting your own

[5] The 2021 survey started in 2020 but was not completed until 2021 due to the COVID-19 pandemic.

business?". The second outcome, level of entrepreneurial interest (LEI), is conditional upon the first one. The subset of students who responded positively to the first outcome were asked in the survey to rate their level of interest in starting their own business. The response could be any of "Very high", "High", "Moderate", "Low" or "Very Low". The main independent variable (treatment) is participation in the intervention, that is, the compulsory entrepreneurship education mandated by the NUC.

Other valuable information in the surveys includes the educational attainment of each of the respondent's parents and whether either of them had any entrepreneurship experience. We use these variables and age, ethnicity, gender, marital status, discipline of study, cumulative grade point average (CGPA), and parents' educational attainment to control for the underlying characteristics of the respondent. We also control for other entrepreneurship-related training that the students may receive either because of their disciplines or as a private arrangement. The literature has found these variables to be among the determinants of individual entrepreneurship intentions in different countries (Eesley & Lee, 2021; Siyanbola et al., 2012; Oosterbeek et al., 2010).

Table 2 contains summary statistics (correlations are reported in Table 6 in Appendix). As expected among undergraduates, most of the sample is under 25 years old and single. Just over a third of the sample is female, and most were studying courses in the sciences or engineering. Despite this disciplinary distribution, a large share (64%) of the sample reported having taken some other entrepreneurship course other than the intervention that this study is focused on. In a sense, this may be related to the highly educated and entrepreneurial family background prevalent in the sample. Eight out of every ten respondents indicated that at least one of their parents had some entrepreneurial experience, and about 50% each of fathers and mothers had a university degree.

Estimation approach

For the evaluation, we use an instrumental variable approach in a difference-in-differences (DiD) framework (Angrist et al., 1996; Ravallion, 2001). This approach has been applied in previous studies on the impact of entrepreneurship interventions (e.g. Eesley & Lee, 2021; Oosterbeek et al., 2010). Let $Y_{D=1,t=1}$ be the mean value of the outcome variable for the intervention group ($D = 1$) after the intervention began ($t = 1$). The corresponding mean value before the start of the intervention ($t = 0$) may be represented as $Y_{D=1,t=0}$. The before–after effect of the intervention can then simply be estimated as $Y_{D=1,t=1} - Y_{D=1,t=0}$. This estimator is, however, confounded by the effect of other intertemporal changes between $t = 0$ and $t = 1$ on $Y_{D=1}$. To remove the confounding effect, we estimate a similar difference for a suitable control group ($D = 0$) and contrast it with the difference for the intervention group. This yields the so-called DiD estimator:

$$\beta = \left(Y_{D=1,t=1} - Y_{D=1,t=0}\right) - \left(Y_{D=0,t=1} - Y_{D=0,t=0}\right) \quad (1)$$

Table 2 Summary statistics

	Full sample			Treatment			Control		
Variable	Obs	Mean	SD	Obs	Mean	SD	Obs	Mean	SD
Student characteristics									
Gender	12,615	0.38	0.49	6,497	0.42	0.49	6,118	0.34	0.47
Age (years)									
16–20	12,615	0.33	0.47	6,497	0.42	0.49	6,118	0.24	0.42
21–25	12,615	0.51	0.50	6,497	0.42	0.49	6,118	0.60	0.49
26–30	12,615	0.12	0.32	6,497	0.10	0.31	6,118	0.13	0.33
Above 30	12,615	0.05	0.21	6,497	0.06	0.23	6,118	0.04	0.18
Marital status									
Single	12,615	0.94	0.23	6,497	0.95	0.22	6,118	0.94	0.24
Married	12,615	0.05	0.22	6,497	0.05	0.22	6,118	0.05	0.22
Divorced/separated	12,615	0.00	0.07	6,497	0.00	0.05	6,118	0.01	0.08
Ethnicity									
Igbo	12,615	0.16	0.36	6,497	0.19	0.39	6,118	0.13	0.33
Hausa	12,615	0.15	0.36	6,497	0.04	0.20	6,118	0.27	0.45
Yoruba	12,615	0.53	0.50	6,497	0.67	0.47	6,118	0.39	0.49
Others	12,615	0.15	0.36	6,497	0.10	0.29	6,118	0.21	0.41
Discipline									
Social sciences	12,615	0.25	0.43	6,497	0.28	0.45	6,118	0.22	0.42
Technology/engineering	12,615	0.30	0.46	6,497	0.32	0.47	6,118	0.27	0.45
Sciences	12,615	0.40	0.49	6,497	0.36	0.48	6,118	0.44	0.50
Others	12,615	0.05	0.22	6,497	0.04	0.20	6,118	0.06	0.24
CGPA									
5.00 +	12,615	0.27	0.44	6,497	0.33	0.47	6,118	0.20	0.40
4.00 +	12,615	0.27	0.44	6,497	0.29	0.45	6,118	0.24	0.43
3.00 +	12,615	0.34	0.47	6,497	0.31	0.46	6,118	0.37	0.48
2.00 +	12,615	0.12	0.32	6,497	0.07	0.25	6,118	0.17	0.38
1.00 +	12,615	0.01	0.11	6,497	0.01	0.08	6,118	0.02	0.13
Less than 1	12,615	0.00	0.03	6,497	0.00	0.03	6,118	0.00	0.04
Has taken other entrepreneurship course	12,615	0.64	0.48	6,497	0.64	0.48	6,118	0.63	0.48
Parent characteristics									
Parents had a business	12,615	0.80	0.40	6,497	0.82	0.39	6,118	0.78	0.41
Father's education									
No formal education	12,615	0.05	0.21	6,497	0.03	0.18	6,118	0.06	0.24
Non-university	12,615	0.40	0.49	6,497	0.35	0.48	6,118	0.45	0.50
University	12,615	0.56	0.50	6,497	0.62	0.49	6,118	0.50	0.50
Mother's education									
No formal education	12,615	0.07	0.25	6,497	0.04	0.20	6,118	0.09	0.29
Non-university	12,615	0.52	0.50	6,497	0.46	0.50	6,118	0.58	0.49
University	12,615	0.42	0.49	6,497	0.50	0.50	6,118	0.33	0.47

In practice, β is derived by regressing intertemporal changes in individual outcomes on the dummy variable for intervention and aggregating the estimates over the entire sample. The regression equation for this procedure is as follows:

$$\Delta Y_{is} = \alpha + \lambda_{is} D + \sum_{t=1}^{t} \gamma_{is} T + \sum_{t=1}^{t} \beta_{ist} D \cdot T + \varepsilon_i \quad (2)$$

where ΔY_{is} is the change in outcome for individual i in university s, D is a dummy variable that equals 1 if individual i has participated in the intervention and 0 otherwise, while ε_i is the idiosyncratic error term. To capture aggregate differences in the sample over time, we include a time dummy T that equals 0 for each treatment unit s in the pre-treatment period and ranges between 1 and 3, respectively, in each post-intervention period.

The estimation setup above implies some important methodological considerations. First, the validity of the DiD approach relies on the comparability of the treatment and control groups. It is therefore important to account for differences between both groups in terms of pre-treatment variables. The choice of university where one studies is not a random choice and this is an important source of pre-treatment difference in our sample. Other personal attributes such as age and gender could confound the analysis. The inclusion of relevant control variables in the estimations helps to address this concern. Yet, the possibility that the treatment and control groups differ in terms of unobservables could affect the measured outcomes. To address this, we instrument participation in the compulsory course with the availability of the compulsory entrepreneurship course in a university. This is a valid instrument because students who attended a university where the compulsory course was available could take the course, unlike students in other universities. Besides, the university that a student attends is not necessarily a strong correlate of their entrepreneurial intentions. Thus, our instrument is correlated with the potentially endogenous independent variable but not with the outcome. The variable D in the estimation, therefore, corresponds to being a student at a university where the intervention was already being implemented.

Second, our identification strategy exploits the fact that students from universities that had implemented the intervention before 2011 were exposed to specific entrepreneurship education but students from the other universities were not able to participate in the intervention. Thus, the instrumental variable estimation identifies the effect of the intervention in the subpopulation which would take the course if it was available in their school but would not take it otherwise, irrespective of whether they had already taken it at the time of the evaluation. This is the so-called intention-to-treat (ITT) estimate. In our setting, it is impossible to obtain the average treatment effect (ATE), that is, the effect of entrepreneurship education among people who would either always or never take the compulsory entrepreneurship elective course regardless of whether it is available in their school or not. This is because in the Nigerian university system, it is currently not possible for students registered in one university to obtain credit from courses in other universities. By accepting that noncompliance is likely to occur in real life and that the timing of compliance is not homogenous within the population, ITT

Table 3 Comparison of EI across groups over time

Year	Total observations	A: share with EI (%)	Total observations	B: share with EI (%)	A–B (z-score)
2007 ($T=0$)	1,012	91.6	737	85.8	5.8**
2011 ($T=1$)	1,806	93.7	1,935	73.1	20.6**
2016 ($T=2$)	1,624	91.4	1,653	93.6	−2.2*
2021 ($T=3$)	2,055	70.1	1,793	95.7	−25.6**

*significant at 5%; **significant at 1%

analysis helps us to avoid overoptimistic estimates of intervention impact resulting from the removal of noncompliers (Gupta, 2011).

Third, some of the respondents might have taken entrepreneurship courses in addition to the policy that we seek to evaluate, either as part of their regular course programme or as a personal effort. Thus, observed effects may not necessarily be due to the policy. Fortunately, the survey asked respondents directly whether they have previously taken any entrepreneurship course. Based on this item, we include in all estimations a control variable for whether or not an individual had taken an additional entrepreneurship course.

Finally, there is a risk of self-selection bias whereby some students participate in the intervention because they already have interest in entrepreneurship. However, the fact that the intervention is a compulsory one eliminates this bias, although we cannot rule out differences in the level of attention and enthusiasm that students will bring to the course. The structure of the data also comes with its own methodological implications. First, individuals from the same school are unlikely to be independently and identically distributed. Their model errors may therefore be correlated, while model errors for individuals in different schools are assumed to be uncorrelated. Second, treatment in our setup is at school level rather than at individual level. The use of clustered standard errors at the school level accounts for these concerns and helps to ensure our results are valid also for students in schools that are not represented in the sample. Additionally, the clustered standard errors account for differences across schools (such as teaching quality).

Empirical results

Descriptive patterns

Table 3 displays the rate of interest in entrepreneurship across the treatment and control groups over time. Of the 12,615 undergraduates in our full sample, 86% indicated that they had interest in starting their own business. At baseline in 2007, 92% of the 1,012 undergraduates in the treatment group expressed interest in entrepreneurship, compared to 86% of the 737 in the control group. The chronological differences are telling. Between 2007 and 2011, there was only a modest increase in the rate of entrepreneurial interest in the treatment group compared to a significant

Table 4 Impact of entrepreneurial education on students' entrepreneurial interest

	(1) Baseline model	(2) Full model (clustered SE)	(3) Full model (fixed effects)
Treatment (*D*)	0.594**	0.378*	−0.133
	(0.242)	(0.224)	(0.175)
2011*Treatment (*D***T*1)	1.102*	0.988**	0.944***
	(0.569)	(0.404)	(0.206)
2016*Treatment (*D***T*2)	−0.906***	−0.700**	−0.842***
	(0.304)	(0.280)	(0.212)
2021*Treatment (*D***T*3)	−2.845***	−2.509***	−2.735***
	(0.824)	(0.708)	(0.208)
Control variables	No	Yes	Yes
University fixed effects	No	No	Yes
Number of obs	12,615	12,615	12,615
Log likelihood	−4584.212	−4252.936	−4172.697
Pseudo-*R*-sq	0.101	0.166	0.181

Clustered standard errors in parentheses; * $p<0.1$, ** $p<0.05$, *** $p<0.01$

decline in the control group. By 2016, a decline which continued until 2021 had begun in the treatment group where, compared to the control group, the intervention had been in operation for much longer. Over the same period, entrepreneurial interest continued to increase in the control group, albeit by a much smaller margin between 2016 and 2021 compared to between 2011 and 2016. These figures suggest two things: one, the rate of entrepreneurial interest among the undergraduates declined significantly in the absence of the intervention; two, the longer the intervention had been in place, the less effect it seems to have on entrepreneurial interest among student cohorts.

These dynamics are more obvious when we combine the intertemporal differences within and between groups (last column in Table 3). In the pre-treatment period (year 2007), entrepreneurial interest in the treated sample was approximately 6 percentage points more than in the untreated sample. In 2011, four years post-treatment, the rate in the treated sample exceeded that in the untreated sample by about 21 percentage points, nearly four times the difference in the pre-treatment period. This clearly suggests that universities which offered the compulsory entrepreneurship education intervention generated a higher interest in self-employment among their students. This proximate effect was earlier reported in Olofinyehun et al (2018). However, by 2016, nine years since the onset of the intervention, the rate of entrepreneurial interest in the treated sample trailed the rate in the untreated sample by about 2 percentage points. This deficit increased to nearly 26 percentage points in 2021, fourteen years after the onset of the intervention. The implication of this finding is that the impact of the intervention is inconsistent over time. Not only does it seem unable to replicate its impact in repeated student cohorts, but the impact also

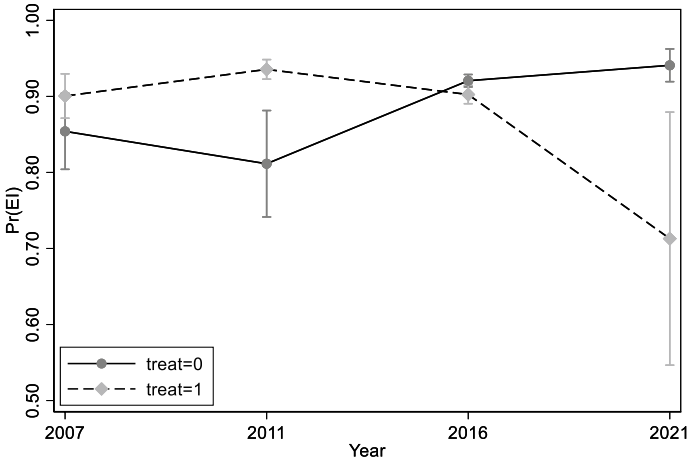

Fig. 3 Predicted probability of entrepreneurial interest over time in treated and untreated samples

altogether seems to reduce progressively over time. In the next section, we examine these findings in a multivariate setting.

Estimation results and robustness checks

The results of estimating Eq. (2) are contained in Table 4. Model 1 contains the results of the baseline estimation including no control variables. Relative to the 2007 levels, the rate of interest in entrepreneurship was significantly higher in the treated than untreated sample in 2011 because of the intervention. This suggests that in comparison with the student cohort that was not exposed to the entrepreneurship course, entrepreneurship interest was higher in the cohort of students who took the course. In particular, the odds of entrepreneurial interest by a student is at least 3 times (that is, $e^{1.102}$) as high if the student has been exposed to the compulsory entrepreneurship course compared to if they had not. In 2016, however, entrepreneurial interest in the treated sample was below that in the untreated sample. The coefficient of –0.906 indicates that the odds of entrepreneurial interest by a student in the intervention group is now only 0.4 times (that is, $e^{-0.906}$) that of a student in the control group. The decline was even greater by 2021, the odds now being only 0.06 times (that is, $e^{-2.845}$) that of a student in the control group.

It must be noted that by 2016, all universities in the sample had introduced the entrepreneurship course (mostly after 2011). Thus, the comparison being made by 2021 is premised on the fact that the treated sample had introduced the policy much earlier (by or before 2007). In other words, this result shows that despite its strong instantaneous effect four years after its commencement, the course became less effective in the medium (nine years) and long term (13 years after commencement). The result remains robust even when we control for several social, demographic, academic and familial factors (Model 2). The direct implication of this result is that the entrepreneurship education intervention fails to consistently deliver the

Table 5 Treatment effect of entrepreneurial education on interest in entrepreneurship

Year	Observations (% treated)	ATET	SE	*z*	*p*-value
2007	1749 (57.86)	0.044	0.017	2.62	0.009
2011	3741 (48.28)	0.141	0.019	7.49	0.00
2016	3277 (49.56)	0.013	0.015	0.89	0.375
2021	3848 (53.40)	− 0.235	0.015	− 15.19	0.00

expected impact even if it starts out as impactful. This pattern is illustrated in Fig. 3 which plots the predicted probability of entrepreneurial interest over time across the treatment and control groups. To further check the robustness of the results, we performed an alternative estimation in which we included university fixed effects instead of clustered standard errors. The results (Model 3) are remarkably similar to our baseline and main estimates in terms of both the magnitude, direction and significance of the effects.

We can infer from the above findings that the intervention has instantaneous but inconsistent impact. Yet, the impact on individual students will be more evidenced if we can track an undergraduate in two parallel scenarios, with all factors remaining identical except for one: in one scenario, they attend a university where they receive compulsory entrepreneurship education, while in the other, they do not. This is analogous to a medical trial scenario, where the effectiveness of a new drug is evaluated by forming a treatment group and a control group. Following this line of reasoning, we establish two distinct groups to conduct a matched pair experimental design. Specifically, within our sample in each year, we identify pairs of undergraduates who possess similar individual characteristics in terms of the same control variables applied in the regression estimation. The sole discrepancy lies in the fact that only one of the two undergraduates attends a university with compulsory entrepreneurship education (the intervention or treatment). To create these pairs, we employ propensity score matching as described in Caliendo and Kopeinig (2008) and widely applied in previous studies (e.g. Buffart et al., 2020; Li et al., 2023). Subsequently, we proceed to evaluate whether this has an observable effect by comparing (level of) entrepreneurial interest within each group. Across all years, the matched pairs are near-perfect replicas (Fig. 4 in Appendix). The results obtained from comparing the matched pairs (Table 5) are consistent with the earlier regression results. Average treatment effect on the treated increased from 2007 to 2011 but fell progressively afterwards until the treatment group lagged the control in terms of entrepreneurial interest.

Discussion and conclusion

The aim of the study was to evaluate the long-term impact of an entrepreneurship education intervention in Nigeria, with a view to establishing the consistency or otherwise of the impact. Starting with a new typification of impacts, we implemented

a DiD estimation using pooled cross-sectional data on over 12,000 undergraduates covering the period from 2007 to 2021. Consistent with earlier studies like Ripollés and Blesa, (2023), Bergmann et al. (2018), Siyanbola et al (2012) and Oosterbeek et al (2010), we find a strong positive impact of the entrepreneurship education intervention. Our study extends the literature by also highlighting the inconsistent impact of the intervention over time. In particular, we found that the longer the intervention lasted, the less effect it had. This means that the policy could not keep making students more interested in entrepreneurship, even if everything else stayed the same. But if policymakers want to reduce youth unemployment and achieve and drive long-term social change, they need to make sure that policies like this one do what they are supposed to do.

Why the policy had instantaneous but inconsistent impact may be related to factors both internal and external to the universities offering the entrepreneurship training. Our data does not include university-based and other relevant variables to empirically explore transmission mechanisms, but we can provide some direction based on our reading of the literature and first-hand knowledge of the context. In several instances, the universities utilised their best and experienced lecturers at the early stages of implementing the interventions. As hands changed, the quality of delivery and consequently the impact of the policy reduced. Similarly, as with most new interventions, the general excitement that came with the new policy, leading to an overall entrepreneurial culture in the universities, might have waned over time, pulling down with it the impact of the policy. These explanations are plausible considering that entrepreneurship training does not operate in isolation; as Valencia-Arias et al. (2021) argued, an entrepreneurial culture impacts on the university environment which in turn impacts on entrepreneurship training. It would be desirable to conduct an additional survey that includes university-related variables to empirically explore these plausible explanations. Notwithstanding, our findings suggest that the relevant stakeholders, especially university-level authorities need to institute deliberate policy learning or policy innovations such as maintaining high-quality but adaptive curricula and delivery systems, creating other interventions additional to the entrepreneurship course, linking the curriculum to entrepreneurship practice, and differentiating the curriculum to match students' pre-course profiles.

Adapting the entrepreneurship training curriculum to students' profiles is particularly desirable because context matters in designing entrepreneurship education for impact. What works for one group of students may not work for another (Maresch et al., 2016; Núñez and Morales-Alonso, 2024). In our empirical setting, an adaptive curriculum would ensure that the training elicits interest in those who do not have it already, as well as strengthen the interest in those who already have it. Doing this effectively will require pre-profiling students to establish their entrepreneurial intention at the point of entry into higher education (Ndofirepi, 2020; van Ewijk et al., 2023). Apart from ensuring that the subsequent education aligns with the varied needs of the students, it also enhances the chances of realising both the alignment and sorting effects of entrepreneurship education as we highlighted in Section "Theoretical background" (Fretschner & Lampe, 2019). In addition, we suggest making the training more practical than theoretical. The concept of experiential entrepreneurship education has grown apace in literature (Morland et al., 2021; Kuratko,

2005). Entrepreneurship training is experiential when it engages the learners, and it is directive and reflective, allowing the learners to explore their personal and all-round development through action (Morland et al., 2021; Boström and Lassen 2006). Ways of doing this include utilising lecturers who are practicing entrepreneurs themselves, who in addition to teaching will be able to mentor the students. Providing empowerment in form of competitive seed grants to students who display personal commitment to the training and excel afterwards is another policy innovation that has proven effective in generating impacts (Klinger & Schündeln, 2011; Berge et al., 2015). The possibility of securing such a grant at the end of the training can make all the difference.

Apart from adding to several strands of the literature, this study points to some issues for future research. First, the high rate of entrepreneurial interest observed has been reported in previous studies. Such high rates are believed to represent a large pool of potential entrepreneurs (Olofinyehun et al., 2018). Siyanbola et al (2012) argued that youth entrepreneurship policies should focus on sustaining this high level of interest among young people and ultimately facilitate business start-ups. An additional empirical contribution of our study is that similar to Oosterbeek et al (2010) in the Netherlands, it is the first rigorous impact evaluation of the nationwide entrepreneurship education intervention in Nigeria, a typical developing country. However, the internal validity comes at a cost: the lack of external validity since we analyse the programme in only a few schools. In this sense, an important implication of our study is that more similar impact evaluations should be conducted in collaboration with implementing universities to explore random allocation of students across treatment and control groups.

Finally, from a theoretical standpoint, this study adds the knowledge that short-term evaluations are by no means sufficient in policy evaluation and review. In so doing, the study overcomes a major limitation in entrepreneurship research, that is, the use of short-term data that fail to control for between-group differences (Ripollés & Blesa, 2023). Although the vast majority of impact evaluations rely on a single baseline and single follow-up survey, our finding that the effect of the entrepreneurship education intervention is not consistent in the long term provides the basis for us to argue that short-term evaluations are insufficient in policy evaluation and review. Repeated evaluations are necessary. The argument here complements the case made in McKenzie (2012) for repeated, long-term measurement of outcomes in impact evaluations. Indeed, the literature on entrepreneurship policy and, more broadly, development, will benefit from a distinction between different levels of impact, as well as from more focus on longer-term impacts of entrepreneurship interventions. Finally, studies that use multidimensional measures of entrepreneurial intention instead of the single item in this study could yield additional insight on the link between entrepreneurial education and youth entrepreneurship behaviour.

Appendix 1

See Fig. 4 and Table 6.

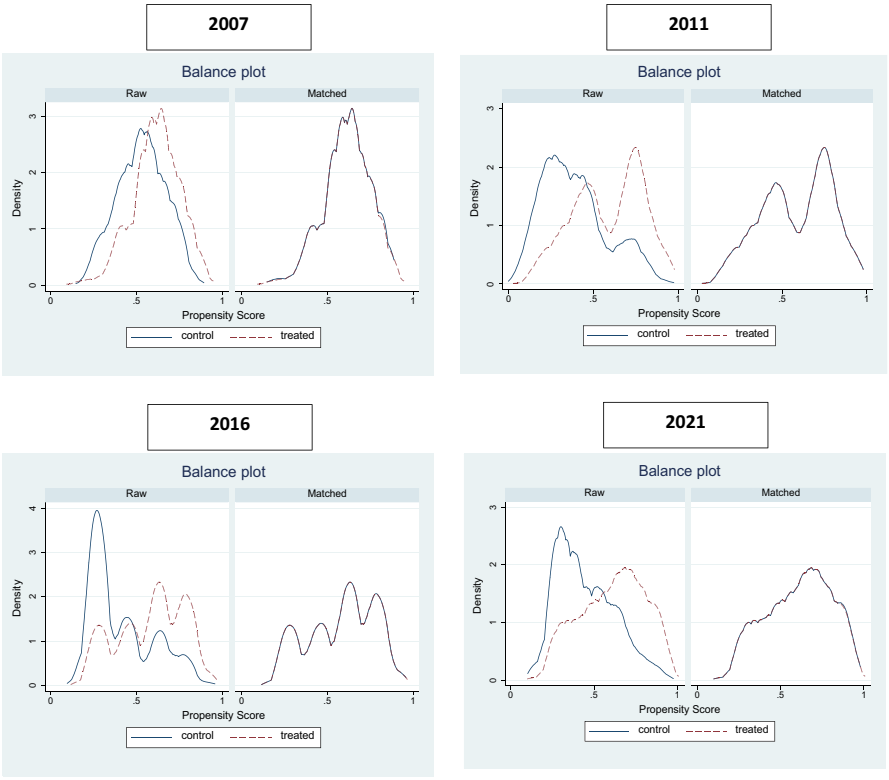

Fig. 4 Balance plots after propensity score matching

Table 6 Correlation matrix

		1	2	3	4	5	6	7	8	9	10
1	Female	–									
2	Age	0.14*	–								
3	Marital status	−0.10*	0.10*	–							
4	Ethnicity	0.04*	0.07*	−0.02*	–						
5	Discipline	0.11*	0.04*	0.00	0.02*	–					
6	CGPA	0.02*	0.00	0.02*	−0.01	−0.01	-				
7	Parents have a business	−0.02*	0.03*	0.07*	−0.03*	0.03*	−0.00	–			
8	Taken entrepreneurship course	0.05*	0.03*	−0.02*	0.01	0.06*	−0.03*	0.06*	–		
9	Father's educational attainment	−0.07*	−0.07*	−0.06*	−0.02	−0.00	−0.024*	−0.05*	−0.02*	–	
10	Mother's educational attainment	−0.07*	−0.09*	−0.06*	−0.03*	−0.01	−0.022*	−0.05*	−0.014	0.57*	1.00

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Max (Mean) VIF = 1.65 (1.17); Condition number = 21.07

Author contributions Abiodun Egbetokun involved in conceptualization, methodology, formal analysis and investigation, writing—original draft preparation, funding acquisition, and supervision; Adedayo Olofinyehun involved in conceptualization, methodology, formal analysis and investigation, data curation, writing—original draft preparation, and writing—review and editing; Caleb Adelowo involved in conceptualization, writing—review and editing, and funding acquisition.

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Data availability This study is based on a pooled dataset, which is published in Data in Brief (https://doi.org/https://doi.org/10.1016/j.dib.2021.107718), and freely available on Mendeley data (https://data.mendeley.com/datasets/zgkxb5tvpg/2).

Declarations

Competing interests The authors declare no competing interests that are relevant for this article.

Ethical approval This is not applicable for this study as human subjects were not involved in a way that could create potential harm. However, informed consent was sought and obtained from the respondents before information was collected from them.

Informed consent In implementing the study, informed consent was a key ethical issue that was considered. Every participant gave their consent before questionnaires were administered. Essentially, they were informed about what participation in the study would entail, and each one had the option to discontinue their participation at any point. Every questionnaire was accompanied by a letter that explained the purpose of the study and the role of the implementing agency.

References

Adeyeye, O., Egbetokun, A., Olofinyehun, A., Oluwadare, A., Sanni, M., Olomu, M. and Orisadare, M. (2022) The design and impact of an apprenticeship-based entrepreneurship intervention in Nigeria: Policy report. NACETEM and CGSPS, Nigeria

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Angrist, J. D., Imbens, G. W., & Rubin, D. B. (1996). Identification of causal effects using instrumental variables. *Journal of the American Statistical Association, 91*(434), 444–455.

Bayer, P., Kennedy, R., Yang, J., & Urpelainen, J. (2020). The need for impact evaluation in electricity access research. *Energy Policy, 137*, 111099.

Becker, G. S. (2009). *Human capital: a theoretical and empirical analysis, with special reference to education*. University of Chicago Press.

Berge, L. I. O., Bjorvatn, K., & Tungodden, B. (2015). Human and financial capital for microenterprise development: Evidence from a field and lab experiment. *Management Science, 61*(4), 707–722. https://doi.org/10.1287/mnsc.2014.1933

Bergmann, H., Geissler, M., Hundt, C., & Grave, B. (2018). The climate for entrepreneurship at higher education institutions. *Research Policy, 47*(4), 700–716.

Bernard, T. (2012). Impact analysis of rural electrification projects in sub-Saharan Africa. *The World Bank Research Observer, 27*(1), 33–51.

Blattman, C., Fiala, N., & Martinez, S. (2014). Generating skilled self-employment in developing countries: Experimental evidence from Uganda. *Quarterly Journal of Economics, 129*(2), 697–752.
Boldureanu, G., Ionescu, A. M., Bercu, A. M., Bedrule-Grigoruță, M. V., & Boldureanu, D. (2020). Entrepreneurship education through successful entrepreneurial models in higher education institutions. *Sustainability, 12*(3), 2–33. https://doi.org/10.3390/su12031267
Boström, L., & Lassen, L. M. (2006). Unraveling learning, learning styles, learning strategies and metacognition. *Education & Training, 48*(2–3), 178–189. https://doi.org/10.1108/00400910610651809
Brooks, W., Donovan, K., & Johnson, T. R. (2018). Mentors or teachers? Microenterprise training in Kenya. *American Economic Journal: Applied Economics, 10*(4), 196–221. https://doi.org/10.1257/app.20170042
Bruhn, M., & Zia, B. (2013). Stimulating managerial capital in emerging markets: The impact of business training for young entrepreneurs. *Journal of Development Effectiveness, 5*(2), 232–266. https://doi.org/10.1080/19439342.2013.780090
Buffart, M., Croidieu, G., Kim, P. H., & Bowman, R. (2020). Even winners need to learn: How government entrepreneurship programs can support innovative ventures. *Research Policy, 49*(10), 104052.
Bulte, E., Lensink, R., & Vu, N. (2017). Do gender and business trainings affect business outcomes? *Experimental Evidence from Vietnam, Management Science, 63*(9), 2885–2902.
Byabashaija, W., & Katono, I. (2011) The impact of college entrepreneurial education on entrepreneurial attitudes and intentions to start a business in Uganda. *Journal of Developmental Entrepreneurship, 16*, 127–144. https://doi.org/10.1142/S1084946711001768
Caliendo, M., & Kopeinig, S. (2008). Some practical guidance for the implementation of propensity score matching. *Journal of Economic Surveys, 22*(1), 31–72.
Della Volpe, M. (2020). Entrepreneurial innovation management: The joint Italy-Colombia master's degree. *International Journal of Educational Management, 34*(1), 70–80.
Díaz-García, C., Sáez-Martínez, F., & Jiménez-Moreno, J. (2015). Assessing the impact of the "Entrepreneurs" education programme on participants' entrepreneurial intentions. *RUSC. Universities and Knowledge Society Journal, 12*(3), 17–31.
Duflo, E., Glennerster, R., & Kremer, M. (2007). Using randomization in development economics research: A toolkit. *Handbook of Development Economics, 4*, 3895–3962.
Eesley, C. E., & Lee, Y. S. (2021). Do university entrepreneurship programs promote entrepreneurship? *Strategic Management Journal, 42*(4), 833–861.
Eesley, C., Li, J. B., & Yang, D. (2016). Does institutional change in universities influence high-tech entrepreneurship?: Evidence from China's project 985. *Organization Science, 27*(2), 446–461.
European Commission. (2012). *Entrepreneurship determinants: Culture and Capabilities*. Luxembourg: Publications Office of the European Union.
Frese, M., Gielnik, M. M., & Mensmann, M. (2016). Psychological training for entrepreneurs to take action: Contributing to poverty reduction in developing countries. *Current Directions in Psychological Science, 25*(3), 196–202.
Fretschner, M., & Lampe, H. W. (2019). Detecting hidden sorting and alignment effects of entrepreneurship education. *Journal of Small Business Management, 57*(4), 1712–1737.
Gennaioli, N., La Porta, R., Lopez-de-Silanes, F., et al. (2013). Human capital and regional development. *Quarterly Journal of Economics, 128*(1), 105–164.
Guerrero, M., & Urbano, D. (2012). The development of an entrepreneurial university. *The Journal of Technology Transfer, 37*(1), 43–74. https://doi.org/10.1007/s10961-010-9171-x
Gupta, S. K. (2011). Intention-to-treat concept: A review. *Perspectives in Clinical Research, 2*(3), 109–112.
Hsu, D., Roberts, E. B., & Eesley, C. (2007). Entrepreneurs from technology-based universities: Evidence from MIT. *Research Policy, 36*, 768–788.
ILO - International Labour Office. (2023). *World employment and social outlook: trends 2023*. ILO.
Karimi, S., Biemans, H. J. A., Lans, T., Chizari, M., Mulder, M., & Naderi Mahdei, N. (2013). Understanding role Models and Gender Influences on Entrepreneurial Intentions Among College Students. *Procedia - Social and Behavioral Sciences, 93*, 204–214. https://doi.org/10.1016/j.sbspro.2013.09.
Karlan, D., Knight, R., & Udry, C. (2015). Consulting and capital experiments with microenterprise tailors in Ghana. *Journal of Economic Behavior and Organization, 118*, 281–302.
Klinger, B., & Schündeln, M. (2011). Can entrepreneurial activity be taught? Quasiexperimental evidence from central America. *World Development, 39*(9), 1592–1610.
Kuratko, D. F. (2005). The emergence of entrepreneurship education: Development trends and challenges. *Entrepreneurship Theory and Practice, 29*(5), 577–598.

Lamine, W., Mian, S., Fayolle, A., & Linton, J. D. (2021). Educating scientists and engineers for technology entrepreneurship in the emerging digital era. *Technological Forecasting and Social Change, 164*, 120552.

Li, Y., Zhang, J., & Lyu, Y. (2023). Does telecommunications infrastructure promote entrepreneurship in developing countries? Evidence from a quasi-natural experiment in China. *Structural Change and Economic Dynamics, 66*, 106–119.

Liñán, F., & Fayolle, A. (2015). A systematic literature review on entrepreneurial intentions: Citation, thematic analyses, and research agenda. *International Entrepreneurship Management 11*, 907–933. https://doi.org/10.1007/s11365-015-0356-5

Mano, Y., Iddrisu, A., Yoshino, Y., & Sonobe, T. (2012). How can micro and small enterprises in Sub-Saharan Africa become more productive? The impacts of experimental basic managerial training. *World Development, 40*(3), 458–468.

Maresch, D., Harms, R., Kailer, N., & Wimmer-Wurm, B. (2016). The impact of entrepreneurship education on the entrepreneurial intention of students in science and engineering versus business studies university programs. *Technological Forecasting and Social Change, 104*, 172–179.

Martínez-Gregorio, S., Badenes-Ribera, L., & Oliver, A. (2021). Effect of entrepreneurship education on entrepreneurship intention and related outcomes in educational contexts: A meta-analysis. *The International Journal of Management Education, 19*(3), 100545.

Mbeteh, A., & Pellegrini, M. M. (2018). Entrepreneurship education in developing countries: a study of the key challenges in Sierra Leone. In L. P. Dana, V. Ratten, & B. Honyenuga (Eds.), *African entrepreneurship. Palgrave studies of entrepreneurship in Africa.* Palgrave Macmillan.

McKenzie, D. (2012). Beyond baseline and follow-up: The case for more T in experiments. *Journal of Development Economics, 99*(2), 210–221.

McKenzie, D. (2017). Identifying and spurring high-growth entrepreneurship: Experimental evidence from a business plan competition. *American Economic Review, 107*(8), 2278–2307.

McKenzie, D., & Woodruff, C. (2014). What are we learning from business training evaluations around the developing world? *World Bank Research Observer, 29*(1), 48–82.

Mok, K. H. (2005). Fostering entrepreneurship: Changing role of government and higher education governance in Hong Kong. *Research Policy, 34*(4), 537–554.

Morland, L., Scott, J. M., & Thompson, J. L. (2021). Experiential entrepreneurship education and the student-focused entrepreneurial university. *Education + Training, 63*(9), 1258–1275.

NBS - National bureau of statistics (2021). Labor force statistics: Unemployment and underemployment report (Q4 2020). Abuja: NBS. Retrieved from https://nigerianstat.gov.ng/download/1238 July 11, 2023

Ndofirepi, T. M. (2020). Relationship between entrepreneurship education and entrepreneurial goal intentions: Psychological traits as mediators. *Journal of Innovation and Entrepreneurship, 9*(2), 1–20.

Nelson, R. E. (1977). Entrepreneurship education in developing countries. *Asian Survey, 17*(9), 880–885.

National Universities Commission. (2019). Nigerian Universities system statistical digest. Abuja: NUC

Núñez, Y. M., & Morales-Alonso, G. (2024). Longitudinal study of necessity-and opportunity-based entrepreneurship upon COVID lockdowns-The importance of misery and economic freedom indexes. *Technological Forecasting and Social Change, 200*, 123079.

Okebukola, P. (2006). Principles and policies guiding current reforms in Nigerian universities. *Journal of Higher Education in Africa/Revue De L'enseignement Supérieur En Afrique, 4*(1), 25–36.

Olofinyehun, A. O., Adelowo, C. M., & Egbetokun, A. A. (2018). The supply of high-quality entrepreneurs in developing countries: Evidence from Nigeria. *Science and Public Policy, 45*(2), 269–282.

Olofinyehun, A., Egbetokun, A., & Adelowo, C. (2022). Pooled dataset on entrepreneurial characteristics of undergraduates in selected universities in Nigeria. *Data in Brief, 40*, 107718.

Oosterbeek, H., Van Praag, M., & Ijsselstein, A. (2010). The impact of entrepreneurship education on entrepreneurship skills and motivation. *European Economic Review, 54*(3), 442–454.

Pritchett, L., & Sandefur, J. (2015). Learning from experiments when context matters. *American Economic Review, 105*(5), 471–475.

Radko, N., Belitski, M., & Kalyuzhnova, Y. (2023). Conceptualising the entrepreneurial university: The stakeholder approach. *The Journal of Technology Transfer, 48*(3), 955–1044.

Rauch, A., & Hulsink, W. (2015). Putting entrepreneurship education where the intention to act lies: An investigation into the impact of entrepreneurship education on entrepreneurial behavior. *Academy of Management Learning & Education, 14*(2), 187–204. https://doi.org/10.5465/amle.2012.0293

Ravallion, M. (2001). The mystery of the vanishing benefits: An introduction to impact evaluation. *The world bank economic review, 15*(1), 115–140.

Regele, M. D., & Neck, H. M. (2012). The Entrepreneurship Education Sub-Ecosystem in the United States: Opportunities to Increase Entrepreneurial Activity. *Journal of Business and Entrepreneurship, 23*(2), 25–47.

Ripollés, M., & Blesa, A. (2023). Moderators of the effect of entrepreneurship education on entrepreneurial action. *International Journal of Entrepreneurial Behavior and Research, 29*(7), 1402–15424.

Rothaermel, F. T., Agung, S. D., & Jiang, L. (2007). University entrepreneurship: A taxonomy of the literature. *Industrial and Corporate Change, 16*(4), 691–791.

Shankar, A. V., Onyura, M. A., & Alderman, J. (2015). Agency-based empowerment training enhances sales capacity of female energy entrepreneurs in Kenya. *Journal of Health Communication, 20*, 67–75. https://doi.org/10.1080/10810730.2014.1002959

Shneor, R., Smith, J. B., Smith, C. G., & Michael Goedecke, J. F. (2021). The differential impact of entrepreneurship education on the entrepreneurial intentions of segments of students. *Entrepreneurship Education and Pedagogy, 4*(4), 718–739.

Siyanbola, W. O., Afolabi, O. O., Jesuleye, O. A., Egbetokun, A. A., Dada, A. D., Aderemi, H. O., Sanni, M., & Rasaq, M. A. (2012). Determinants of entrepreneurial propensity of Nigerian undergraduates: An empirical assessment. *International Journal of Business Environment, 5*(1), 1–29.

Slavtchev, V., Laspita, S., & Patzelt, H. (2012). *Effects of entrepreneurship education at universities* (No. 2012, 025). Jena economic research papers. Friedrich Schiller University Jena and Max Planck Institute of Economics, Jena

Valencia-Arias, A., Arango-Botero, D., & Sanchez-Torres, J. A. (2021). Promoting entrepreneurship based on university students' perceptions of entrepreneurial attitude, university environment, entrepreneurial culture and entrepreneurial training. *Higher Education, Skills and Work-Based Learning, 12*(2), 328–345.

Valerio, A., Parton, B., & Robb, A. (2014). *Entrepreneurship Education and Training programs around the World: Dimensions for success*. Washington DC: World Bank Publications. https://doi.org/10.1596/978-1-4648-0202-7

Van Auken, H., Fry, F. L., & Stephens, P. (2006). The influence of role models on entrepreneurial intentions. *Journal of Developmental Entrepreneurship, 11*, 157–167. https://doi.org/10.1142/S1084946706000349

van Ewijk, A. R., Cheng, J., & Chang, F. Y. (2023). Why is changing students' entrepreneurial intentions so hard? On dissonance reduction and the self-imposed self-fulfilling prophecy. *The International Journal of Management Education, 21*(3), 100896.

Van Praag, C. M., & Versloot, P. (2007). What is the value of entrepreneurship? A review of recent research. *Small Business Economics, 29*(4), 351–382.

Von Graevenitz, G., Harhoff, D., & Weber, R. (2010). The effects of entrepreneurship education. *Journal of Economic Behavior and Organization, 76*, 90–112.

Walter, S. G., Parboteeah, K. P., & Walter, A. (2013). University departments and self–employment intentions of business students: A cross–level analysis. *Entrepreneurship Theory and Practice, 37*(2), 175–200.

Wennekers, S., & Thurik, R. (1999). Linking entrepreneurship and economic growth. *Small Business Economics 13*, 27–56. https://doi.org/10.1023/A:1008063200484

Yami, S., M'Chirgui, Z., Spano, C., & Barykina, O. G. (2021). Reinventing science and technology entrepreneurship education: The role of human and social capitals. *Technological Forecasting and Social Change, 164*, 120044.

Yatu, L., Bell, R., & Loon, M. (2018). Entrepreneurship education research in Nigeria: Current foci and future research agendas. *African Journal of Economic and Management Studies, 9*(2), 165–177.

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