A hybrid approach to sustainable development competencies: the role of formal, informal and non-formal learning experiences

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Abstract

Purpose – This paper aims to explore whether formal, non-formal, and informal learning experiences contribute to developing sustainable development competencies (SDCs) among students in a Principles of Responsible Management Education (PRME) signatory business school.

Design/methodology/approach – An online survey based on the students' learning experiences and a questionnaire on sustainability competencies already validated in the literature were given to a sample of 274 bachelor students at a PRME signatory business school. Nominal variables representing students' categories were created to test a set of hypotheses developed according to the literature. Because the data was not normally distributed, non-parametric independent-samples Mann–Whitney U test was conducted, and descriptive statistics was used to help the analysis.

Findings – The results suggest that a hybrid format with a combination of formal, non-formal and informal learning experiences is essential to maximising the development of SDCs and raising students' sustainability literacy.

Research limitations/implications – This study is one of the first attempts to understand the importance of a hybrid approach in developing sustainable competencies (SDCs). Future studies could adopt longitudinal analysis to check the development of these competencies over time, assess students from different PRME signatory schools or comparing students to those in non-signatory business schools.

Practical implications – This study provides insight into how business schools could address challenges in developing sustainable competencies through redirecting their educational systems by balancing formal, informal and non-formal learning approaches to educate future responsible leaders.

Originality/value – This research provides evidence on how a hybrid learning approach could maximise the development of sustainable development competencies and, therefore, generating insights for educational policies.

Keywords Management education, Higher education institutions, PRME, Sustainable development competencies, Learning experiences

Paper type Research paper

1. Introduction

The scientific community states that people are pushing the earth's systems far beyond their limits of viability (Griggs *et al.*, 2013; Rockström *et al.*, 2009). Among the several research strands on sustainable development (SD), scholars are currently addressing the extent to

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which higher education institutions (HEIs) play a role (Findler *et al.*, 2019; Kurucz *et al.*, 2017; Leal Filho *et al.*, 2019, 2021; Starik *et al.*, 2010; Stead and Stead, 2010; Storey *et al.*, 2017, 2019) in helping society guarantee economic growth, social justice and environmental preservation (United Nations, General Assembly, 2015). This perspective gained force, especially after the launch of Principles of Responsible Management Education (PRME), promoted by the United Nations (UN) (United Nations, PRME, 2020).

Among the several types of HEIs, business schools are particularly relevant, given that one of their core activities is concerned with the education of future managers and leaders (Kurucz *et al.*, 2017) who will eventually hold important positions at private corporations, in the public sector, with non-governmental organisations (NGOs), or through entrepreneurship activities. In other words, PRME signatory business schools are expected to educate decision-makers concerned with balancing the economic, social and environmental dimensions of sustainability (United Nations, PRME, 2020). This could, therefore, help ensure firms are "meeting the needs of a firm's direct and indirect stakeholders without compromising its ability to meet the needs of future stakeholders as well" (Dyllick and Hockerts, 2002, p. 131).

In this context, PRME signatory institutions focus on three main pillars: research, extension and education. Therefore, PRME signatory schools are not only expected to produce relevant research and address corporate sustainability and corporate social responsibility in their formal curricula but also to generate positive externalities to the community through extension and extracurricular activities that follow the UN's Sustainable Development Goals (SGDs) and the PRME principles (United Nations, General Assembly, 2015; United Nations, PRME, 2020).

To this end, HEIs need to continually improve learning experiences to educate well-versed future sustainability leaders (Dyer and Dyer, 2017; Sroufe *et al.*, 2015) with the knowledge, skills, attitudes and other characteristics, allowing them to become change agents in the organisations where they work and in the communities where they live and interact (Lozano *et al.*, 2015). The literature is currently developing this perspective; however, there is still a paucity in understanding about the role of formal, non-formal and informal educational experiences in developing students prepared for sustainability challenges (The Council of the European Union, 2018; UNESCO, 2017). Therefore, this work aims to address this gap through the following research question:

Q1. How do formal, non-formal and informal learning experiences contribute to developing sustainable development competencies (SDCs) and knowledge among students in a PRME signatory business school?

To address this gap, the authors conducted an online survey, based on a questionnaire that was already validated in literature (Ploum *et al.*, 2018), among 274 students at a PRME signatory business school at the most prominent university in Brazil and Latin America in terms of number of students and academic research. The students were asked to answer questions regarding their SDCs (diversity, foresighted thinking, systems thinking, normative, action, interpersonal and strategic management; Ploum *et al.*, 2018), knowledge level about the SDGs (United Nations, General Assembly, 2015) and their formal and non-formal learning experiences during college (UNESCO, 2017). The authors also used descriptive statistics to understand the sample and conducted non-parametric tests to understand the differences between the various student categories. Additionally, following the research question previously mentioned, secondary goals were also developed according to the literature and investigated through a set of hypotheses presented in Table 1.

The remainder of this paper is structured in a sequence of four sections. The introduction contextualises the reader and presents the research goals. The literature review provides an

overview of SDCs and supports the set of hypotheses presented in Table 1. Section 3 explains the methods and techniques adopted to tackle the goals. Section 4 presents the main results, and Section 5 provides a discussion, conclusions and practical implications. Limitations of this study, as well as future research opportunities, are also addressed.

2. Theoretical background and hypotheses

In the past few years, discussion about the importance of integrating sustainability and responsible management practices into the curriculum of business schools has increased significantly (Aragon-Correa *et al.*, 2017; Bradley, 2019; Chen *et al.*, 2018; Kurucz *et al.*, 2014, 2014; Mburayi and Wall, 2018; Rusinko, 2010; Starik *et al.*, 2010; Stead and Stead, 2010; Storey *et al.*, 2017, 2019; Stough *et al.*, 2018; United Nations, PRME, 2020). Moreover, educating students well-versed in sustainability issues and systemically inserting sustainability into educational systems became a relevant strategy for HEIs interested in promoting SD (Findler *et al.*, 2019; Leal Filho, Vargas, *et al.*, 2019; Leal Filho *et al.*, 2021; Menon and Suresh, 2020; Nousheen *et al.*, 2020).

Categories	Dimension	Hypothesis	Main references
Formal learning	Time in undergraduate programme	*H1a*. Students enrolled in the third year or later of a PRME signatory business school have developed higher levels of SDCs than have those enrolled in the first two years *H1b*. Students enrolled in the third year or later of a PRME signatory business school present higher levels of knowledge about SDGs than do those enrolled in the first two years	The Council of the European Union (2018), UNESCO (2017), United Nations, PRME (2020)
	Chosen major	*H2a*. Students enrolled in business administration have developed higher levels of SDCs than those enrolled in economics and accounting *H2b*. Students enrolled in business administration have developed higher levels of knowledge about SDGs than have those enrolled in economics and accounting	Bradley (2019), Lim *et al.* (2015), Mburayi and Wall (2018)
Non-formal and informal learning	*(Non-formal learning)* Engagement in student organisations	*H3a*. Students engaged in student organisations have developed a higher level of SDCs than those who were not involved *H3b*. Students engaged in student organisations have developed a higher level of knowledge about SDGs than those who were not	Borges *et al.* (2017a), (2017b)
	(Informal learning) Internship/ working experiences	*H4a*. Students who had working or internship experiences have developed higher levels of SDCs than have those who did not *H4b*. Students who had working or internship experiences have developed more knowledge about SDGs and PRME than have those who did not	Cebrián *et al.* (2020), European Commission (2012), Gramatakos and Lavau (2019), The Council of the European Union (2018), UNESCO (2017)

Source: Developed by the authors, based on the literature

Table 1.
Hypotheses setting

Most recently, significant attention has been focused on the individual level, on the extent to which HEIs can develop in students the SDCs required to deal with the complexity and often paradoxical aspects of sustainability challenges they will face as leaders or managers (Besong and Holland, 2015; Brundiers *et al.*, 2021; Lambrechts and Van Petegem, 2016; Levesque and Blackstone, 2020; Pacis and VanWynsberghe, 2020; Ploum *et al.*, 2018; Redman *et al.*, 2021; Wiek *et al.*, 2015). Despite the discussion of what SDCs might be and why they are important for achieving SDGs (Lans *et al.*, 2014; Osagie *et al.*, 2016; Ploum *et al.*, 2018; Wesselink *et al.*, 2015), there is a discussion of whether these competencies are best developed through formal, non-formal or informal learning experiences (The Council of the European Union, 2018; UNESCO, 2017). For example, Giangrande *et al.* (2019) argue that intrapersonal transformation and active learning focusing on non-formal education are essential factors for education for SD (ESD) and the development of SDCs. Sady *et al.* (2019) illustrate how Polish universities adopt formal and non-formal strategies in shaping their students' SDCs through their formal educational programmes and extracurricular activities. Elmassah *et al.* (2020) explore the extent to which formal and non-formal educational practices – which are classified into four categories: learning to know, learning to do, learning to be and learn to live together – could develop the SDCs.

Moreover, the learning approaches previously discussed could shed light on what policies and practices universities could undertake to foster ESD and, therefore, help society meet the SDGs (Leal Filho *et al.*, 2018; The Council of the European Union, 2018; UNESCO, 2017). Examples of these policies and practices usually focus on the extent to which universities could adopt green campus procedures, SD in the curriculum, SD and networking, SD and training, SD and outreach, SD and procurement, SD and student's engagement, joint local SD activities and international networking on SD (Leal Filho *et al.*, 2018). There is also a common sense that educational policies could foster ESD at universities by implementing cross-discipline learning, innovative teaching and learning methodologies (e.g. inquiry-based, project-based, problem-based learning and business simulations). In addition, formal, non-formal and informal learning approaches might play an important role through student-led community activities such as work-based learning or the establishment of partnerships with other actors such as companies and other universities to promote lifelong learning (The Council of the European Union, 2018; UNESCO, 2017).

2.1 Formal learning on sustainability literacy

Formal learning consists of "learning which takes place in an organised and structured environment, specifically dedicated to learning, and typically leads to the award of a qualification, usually in the form of a certificate or a diploma" (European Commission, 2012, p. 4). It contributes to developing essential SDCs and knowledge among students mainly by planning strategies to address sustainability into the formal curricula of HEIs (Bradley, 2019; Elmassah *et al.*, 2020; Hay and Eagle, 2020; Leal Filho, Skanavis, *et al.*, 2019; Lengyel *et al.*, 2019; United Nations, PRME, 2020). Despite the formal curricula, the institutional role of HEIs that are engaged in ESD could also provide an educational environment that enables the development of sustainable competencies (Albareda-Tiana *et al.*, 2018; Olweny, 2018). In this sense, it is expected that undergraduate students enrolled in PRME signatory business schools are likely to develop sustainability knowledge and competencies as they move through their courses and experience the pro-sustainability formal learning environment PRME business schools provide:

H1a. Students enrolled in the third year or later of a PRME signatory business school have developed higher levels of SDCs than have those enrolled in the first two years.

H1b. Students enrolled in the third year or later of a PRME signatory business school present higher levels of knowledge about SDGs than do those enrolled in the first two years.

Despite the number of years in formal education, studies also indicate that economics and accounting courses and fields struggle to incorporate sustainability into their formal curricula (Bradley, 2019; Mburayi and Wall, 2018). According to Bradley (2019), the lack of integration of sustainability throughout introductory economic courses is the most concerning barrier that inhibits student attainment of ESD. The study also notes that economic courses put little emphasis on sustainability and environmental concerns for reasons that include lack of motivation among staff, specialisation and monism of economics, narrow focus and the influence of mainstream neoclassical economics in teaching (Bradley, 2019). Mburayi and Wall (2018) agree that economics and accounting courses have shown reluctance to educate on sustainability or to address sustainability problems and environmental concerns. By contrast, management courses are more likely to provide students with interdisciplinarity and pluralism and to implement EDS throughout the curriculum, as management education benefits from the insertion of sustainability across disciplines (Annan-Diab and Molinari, 2017; Hesselbarth and Schaltegger, 2014).

Based on these findings, it is expected that business management students are more likely to develop SDCs than accounting and economics students. This difference might rely on the fact that business management courses seem to embed interdisciplinarity and pluralism into a formal curriculum easier and faster than economics and accounting courses, implying fewer barriers to integrating SD concerns into the formal curriculum:

H2a. Students enrolled in business administration have developed higher levels of SDCs than have those enrolled in economics and accounting.

H2b. Students enrolled in business administration have developed higher knowledge levels about SDGs than have those enrolled in economics and accounting.

2.2 Informal and non-formal learning on sustainability literacy

Non-formal learning, on the other hand, embraces "learning which takes place through planned activities where some form of learning support is present" (European Commission, 2012, p.4). Unlike formal learning, it involves some form of learning through school-sponsored activities but is not related to the formal curricula or educational projects that could develop SDCs and sustainability literacy among students (Affeldt *et al.*, 2015; Elmassah *et al.*, 2020; Rogers, 2019; Wals *et al.*, 2017).

Some studies show that non-formal education increases student engagement and willingness to participate in sustainability practices (Elmassah *et al.*, 2020; Ouellet Dallaire *et al.*, 2018). Additionally, many of these non-formal learning experiences also come from students' willingness to engage in student organisations at their universities, further impacting local communities (Borges, Cezarino *et al.*, 2017a, 2017b; Rogers, 2019). Within this context, students can impact the community while following the university's formal education. Therefore, participation in a student organisation could develop knowledge, personal and professional skills that the formal curriculum cannot (Borges *et al.*, 2017a, 2017b):

H3a. Students engaged in student organisations have developed a higher level of SDCs than those who were not involved.

H3b. Students engaged in student organisations have developed a higher level of knowledge about SDCs than those who were not.

The literature also suggests that informal learning can develop sustainability literacy. In this context, informal learning means "learning resulting from daily activities related to work, family or leisure and is not organised or structured in terms of objectives" (European Commission, 2012, p. 4). Therefore, working and internship experiences are not considered school-sponsored activities; however, they play a definite role in developing SDCs for lifelong learning (European Commission, 2012; The Council of the European Union, 2018; UNESCO, 2017). Accordingly, working experiences and internship programmes could positively affect student's SDCs and SD literacy through networking with other stakeholders or real-world learning experiences (Brundiers *et al.*, 2010; Brundiers and Wiek, 2017; Remington-Doucette *et al.*, 2013; The Council of the European Union, 2018; Wiek *et al.*, 2014). Therefore, students who had working or internship experiences are expected to have developed more SDCs:

H4a. Students who had working or internship experiences have developed higher levels of SDCs than have those who did not.

H4b. Students who had working or internship experiences have more knowledge about SDGs than do those who did not.

3. Methods

3.1 Research setting

This work encompasses data gathered from a sample of 274 students from a PRME signatory business school at the most prominent Brazilian university based on the number of students and research published. The related business school has been an advanced PRME signatory since April 2012 and focuses on graduate and undergraduate teaching, research and extension on business administration, accounting and economics. Additionally, it is recognised as focusing on the education of future leaders and managers who will work to meet the SDGs. In this sense, the business school also considers the students to be change-makers, which is not only incorporated into the formal curriculum but also affects the university's community.

From the formal education perspective, the business school is a PRME signatory, is engaged in research on sustainability. Additionally, the formal curricula are directly or indirectly related to SD (e.g. logistics and supply chain management, corporate social responsibility, sociology of consumption, sustainable agribusiness, environment and sustainability, network cooperation and management, management based on dialogue and innovation management).

From the non-formal education perspective, the business school is engaged in creating an open learning environment, encouraging student-centred experiences, developing communication channels and generating opportunities to build competencies that are usually hard to develop inside the classroom. Examples of that rely on the business school's diverse environment and the active participation of the extracurricular activities through 15 student organisations, which are also institutionalised and recognised by the university management.

3.2 Data collection

An online survey was conducted among the students at the PRME signatory business school. Overall, 20% of the business school students answered the survey, resulting in a sample of 274 students. Of the 274 participants in the study, 122 students were female (45 %), and 152 were male (55 %). Concerning education, of the total sample, 150 students are enrolled in business administration (55 %), and the other 124 (45 %) in accounting and economic sciences. The survey was based on the Ploum *et al.*, SDCs article (Ploum *et al.*, 2018). The questionnaire consists of seven SDCs, and each competence has a set of questions that the students can give themselves a mark between 1 and 10 (1 = low and 10 = high). The questionnaire was obtained by asking the main author directly by email, who kindly replied and sent them. The SDCs explored are presented in Table 2.

Additionally, another question was added to the sustainability competencies questionnaire: what is your level of knowledge about the SDGs? This question was also answered based on a ten-point scale and was considered essential for assessing the students' level of knowledge about SDGs. The answers were important not only for theoretical discussions but also for practical implications for the university management.

All six authors of this article independently translated the instrument into Brazilian Portuguese. All translated versions were compared in a research committee, and the best version was compiled based on the six translations. The questionnaire was then back-translated, allowing the authors to confirm if the meaning was preserved from the original. The second part of the original questionnaire regarding the assessment of entrepreneurship intentions was excluded because it did not address the specific research theme.

Data collection took place at the beginning of students' classes. The authors sent an email to each of the business school professors, asking their permission to use the first few minutes of their classes. After their acceptance, the students were approached by handing out papers with a quick response (QR) code. Students were instructed to take a picture of the

Competence	Description
Systems thinking competence	"The ability to identify and analyse all relevant (sub)systems across different domains (people, planet, profit) and disciplines, including their boundaries"
Embracing diversity and interdisciplinary competence	"The ability to structure relationships, spot issues, and recognise the legitimacy of other viewpoints in business decision-making processes; be it about environmental, social, and/or economic issues"
Foresighted thinking competence	"The ability to collectively analyse, evaluate, and craft "pictures" of the future in which the impact of local and/or short-term decisions on environmental, social, and economic issues is viewed on a global/ cosmopolitan scale and in the long term"
Normative competence	"The ability to map, apply, and reconcile sustainability values, principles, and targets with internal and external stakeholders, without embracing any given norm but based on the good character of the one who is involved in sustainability issues"
Action competence	"The ability to actively involve oneself in responsible actions for the improvement of the sustainability of social-ecological systems"
Interpersonal competence	"The ability to motivate, enable, and facilitate collaborative and participatory sustainability activities and research"
Strategic management competence	"The ability to collectively design projects, implement interventions, transitions, and strategies for sustainable development practices"

Source: Ploum *et al.* (2018, p. 119)

Table 2. Sustainability competencies

QR code, read the instructions, and, if they agreed with the informed consent form, were automatically transferred to *Google Forms* to begin to answer the questionnaire.

3.3 Data analysis

The analysis strategy was developed according to the specific goals related to each one of the hypotheses previously presented in the introduction section. Data was organised in a single spreadsheet, and the average of responses to each question was calculated for each SDC. The raw data was checked, and to perform the hypothesis test, dummies were created, with 1 standing for Group 1 and 0 for Group 2. Table 3 illustrates the difference between each group.

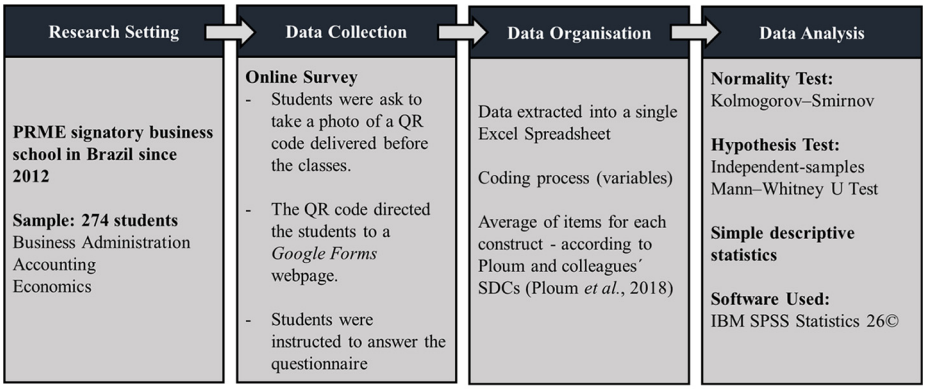
In a second stage, the spreadsheet with the questionnaire's answers was imported into the IBM SPSS Statistics 26 software for analysis. Figure 1 summarises the main methodological steps previously discussed and the data analysis techniques applied to obtain the results.

During the data analysis stage, the authors performed normality tests to understand the sample and check if the independent samples from each category followed normal probability distribution through the Kolmogorov–Smirnov test. Normality tests use p-values to understand if the data are normally distributed. Because the data from the groups presented were not normally distributed ($p < 0.05$), the analyses followed the non-parametric independent-samples Mann–Whitney U test (Hair *et al.*, 1998).

Themes	Categories
Years in formal education	Category A1: students enrolled in the first two years
	Category A2: students enrolled in the third year or later
Chosen major	Category B1: business administration students
	Category B2: other graduation majors (accounting and economics)
Students organisation engagement	Category C1: students engaged in at least one year in student organisations
	Category C2: students involved in less than one year in student organisations
Internship/working experiences	Category D1: students with at least two years of working/internship experiences
	Category D2: students with less than two years of working/internship experiences

Source: Developed by the authors

Table 3.
Categories



Source: Developed by the authors

Figure 1.
Research setting

4. Findings

4.1 Time in undergraduate programme

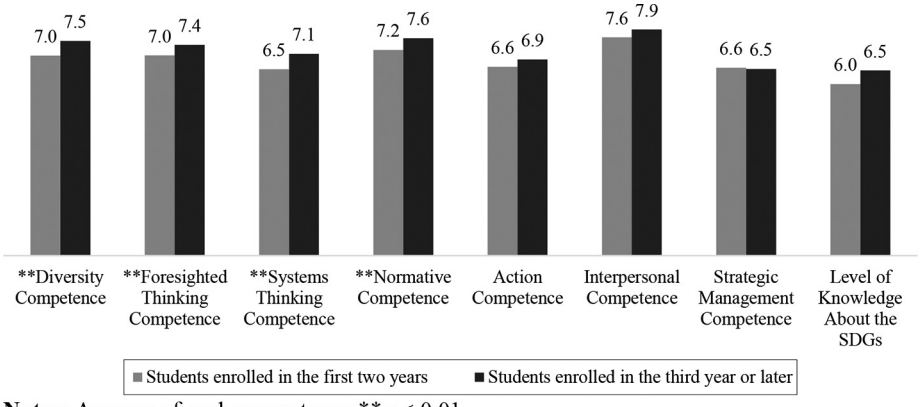
Table 4 shows the results for the number of years of formal education in each category. Based on these results, the null hypothesis was rejected for diversity, foresighted thinking, systems thinking and normative competencies, indicating that the distribution of these competencies is significantly different from students enrolled in the third year or later to those enrolled in the first two years ($p < 0.01$).

The results indicated in Table 4 are better understood when compared to Figure 2. On average, students in their last years of university had developed the competencies considered essential for SD; however, the hypothesis developed according to the literature (*H1a*) was supported only for the diversity, foresighted, normative and systems thinking

Competencies	Null hypothesis	Sig.
Diversity competence	The distribution of *diversity competence* is the same across categories	0.001**
Foresighted thinking competence	The distribution of f*oresighted thinking competence* is the same across categories	0.004**
Systems thinking competence	The distribution of *systems thinking competence* is the same across categories	0.002**
Normative competence	The distribution of *normative competence* is the same across categories	0.006**
Action competence	The distribution of *action competence* is the same across categories	0.079
Interpersonal competence	The distribution of *interpersonal competence* is the same across categories	0.070
Strategic management competence	The distribution of *strategic management competence* is the same across categories	0.993
Level of knowledge about SGDs	The distribution of *level of knowledge about SDGs* is the same across the categories	0.089

Notes: Independent-samples Mann–Whitney U test. **$p < 0.01$. Category A1: students enrolled in the first two years. Category A2: students enrolled in the third year or later

Table 4. Hypothesis test summary – years of formal education



Notes: Average of each competency **$p < 0.01$

Figure 2. Years in formal education

competencies. Also, *H1b*, related to the level of knowledge students hold about the SDGs was not supported, showing no statistical difference between Categories A1 and A2.

4.2 Chosen major

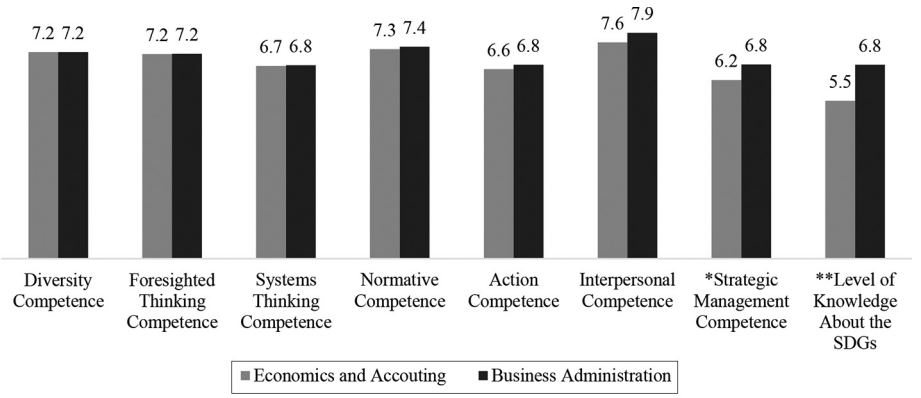
Table 5 explicitly compares results for students who had chosen the business administration major with those who had chosen other majors (accounting and economics). Therefore, according to the results, students enrolled in business administration showed statistical differences from economics and accounting students regarding strategic management competence ($p < 0.05$) and knowledge about the SDGs ($p < 0.01$).

Additionally, according to Figure 3, despite the strategic management competence and the knowledge students held about SDGs, all the other competencies important for SD

Theme	Null hypothesis	Sig.
Diversity competence	The distribution of *diversity competence* is the same across categories	0.902
Foresighted thinking competence	The distribution of *foresighted thinking competence* is the same across categories	0.904
Systems thinking competence	The distribution of *systems thinking competence* is the same across categories	0.813
Normative competence	The distribution of *normative competence* is the same across categories	0.677
Action competence	The distribution of *action competence* is the same across categories	0.650
Interpersonal competence	The distribution of *interpersonal competence* is the same across categories	0.064
Strategic management competence	The distribution of *strategic management competence* is the same across categories	0.015*
Level of knowledge about SGDs	The distribution of *level of knowledge about SDGs* is the same across the categories	0.003**

Notes: Independent-samples Mann–Whitney U test. *$p < 0.05$; **$p < 0.01$. Category B1: business administration students. Category B2: other undergraduate majors (economics and accounting)

Table 5.
Hypothesis test summary – business school majors



Notes: Average of each competency *$p < 0.05$; **$p < 0.01$

Figure 3.
Business school majors

showed no statistical difference between Categories B1 and B2, meaning the null hypothesis is retained. As a result, *H2b* is supported, and *H2a* is supported only for strategic management competence.

4.3 Student organisation engagement

Among the seven SDCs, student organisation engagement demonstrated relevance to developing three competencies and knowledge about SDGs. Therefore, the results suggest statistical significance in diversity ($p < 0.01$), systems-thinking ($p < 0.05$) and strategic management ($p < 0.01$). Also, knowledge about SDGs was different between the groups of students engaged in student organisations and those who were not ($p < 0.01$).

Analysis of Table 6 and Figure 4 shows evidence that the levels of competencies in both groups were high. The most evident result between the categories analysed relies on the higher differences of level of knowledge about SDGs (difference of 0.9), diversity competence (0.6) and strategic management (0.6). Therefore, *H3b* is confirmed, and *H3a* is confirmed only for systems thinking and strategic management competencies.

4.4 Working/internship experiences

Finally, the dimension regarding students with working/internship experiences showed that most SDCs demonstrated higher levels of development, with statistical differences between Categories D1 and D2: diversity, foresighted thinking ($p < 0.001$), systems thinking, action and interpersonal ($p < 0.01$) and normative competence ($p < 0.05$) (Table 7).

The results suggest that working or internship experiences are important for developing most of the SDCs. As a result, *H4b* is rejected, while *H4a* is retained for the diversity, foresighted-thinking, systems thinking, normative, action and interpersonal competencies (Figure 5).

5. Discussions

This paper aimed to address the extent to which formal, non-formal and informal approaches play in developing SDCs and sustainability literacy among students in a

Theme	Null hypothesis	Sig.
Diversity competence	The distribution of *diversity competence* is the same across categories	0.001**
Foresighted thinking competence	The distribution of *foresighted thinking competence* is the same across categories	0.057
Systems thinking competence	The distribution of *systems thinking competence* is the same across categories	0.025*
Normative competence	The distribution of *normative competence* is the same across categories	0.054
Action competence	The distribution of *action competence* is the same across categories	0.065
Interpersonal competence	The distribution of *interpersonal competence* is the same across categories	0.093
Strategic management competence	The distribution of *strategic management competence* is the same across categories	0.008**
Level of knowledge about SDGs	The distribution of *level of knowledge about SDGs* is the same across the categories	0.008**

Notes: Independent-samples Mann–Whitney U test. *$p < 0.05$; **$p < 0.01$. Category C1: students engaged in at least one year in student organisations. Category C2: students involved in less than one year in student organisations

Table 6. Hypothesis test summary – student organisation's engagement

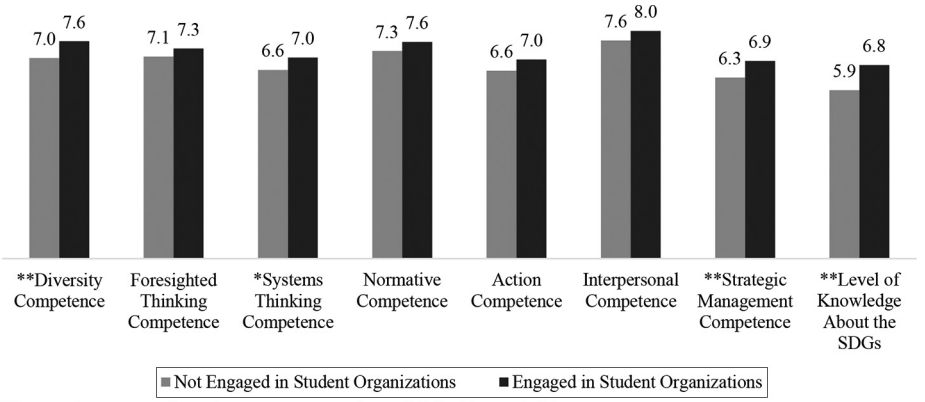


Figure 4.
Student Organisation Engagement

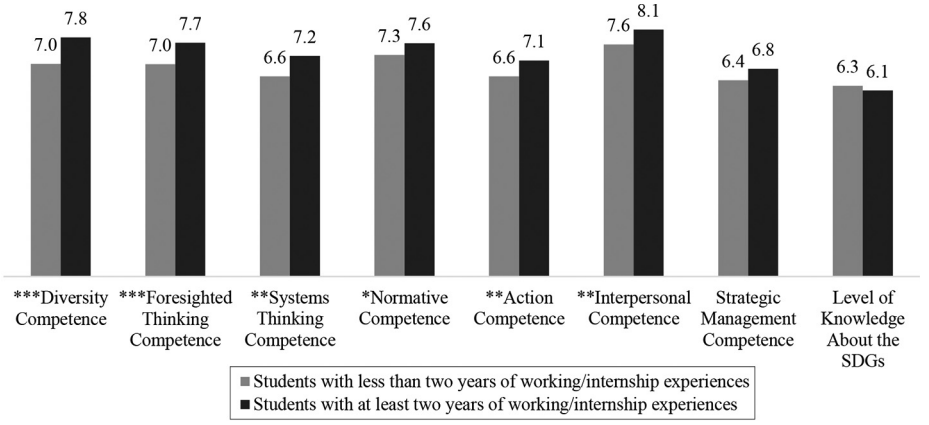
Notes: Average of each competency *$p < 0.05$; **$p < 0.01$

Theme	Null hypothesis	Sig.
Diversity competence	The distribution of *diversity competence* is the same across categories	0.000***
Foresighted thinking competence	The distribution of *foresighted thinking competence* is the same across categories	0.000***
Systems thinking competence	The distribution of *systems thinking competence* is the same across categories	0.002**
Normative competence	The distribution of *normative competence* is the same across categories	0.025*
Action competence	The distribution of *action competence* is the same across categories	0.003**
Interpersonal competence	The distribution of *interpersonal competence* is the same across categories	0.008**
Strategic Management Competence	The distribution of s*trategic management competence* is the same across categories	0.084
Level of Knowledge about SDGs	The distribution of *level of knowledge about the SDGs* is the same across the categories	0.811

Table 7.
Hypothesis test summary – working/internship experiences

Notes: Independent-samples Mann–Whitney U test. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$. Category D1: students with at least two years of working/internship experiences. Category D2: students with less than two years of working/internship experiences

Brazilian PRME signatory business school. The findings presented in the previous section confirm our prediction that students differed based on categories regarding the development of SDCs and sustainability knowledge, suggesting that different learning experiences might cause students to develop different sustainability competencies. In addition, the fact that not all the hypotheses were confirmed for a specific learning experience led us to believe that although all the approaches studied are important individually, a hybrid approach might result in a more effective strategy through which PRME business schools can foster a combination of formal, non-formal and informal learning strategies as an effective way to develop in students' knowledge about SDGs and the SDCs suggested by Ploum *et al.* (2018).



Notes: Average of each competency *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Figure 5.
Internship/working experiences

Table 8 summarises this perspective, providing evidence that, in the specific PRME business school explored, none of the learning experience categories alone could provide the development of the SDGs knowledge and the full set of competencies proposed by Ploum *et al.* (2018). For example, none of the formal learning experiences (time in undergraduate program and chosen courses) developed action and interpersonal competencies; engagement in student organisations (non-formal learning) was not a significant factor in the development of important competencies such as foresighted thinking, normative, action and interpersonal, and working or internship learning experiences (informal learning) were the most effective; however, these experiences could not develop strategic management competence and ensure students possessed knowledge about SDGs. Therefore, the results are also synergetic with Elmassah *et al.*'s (2020) findings, suggesting that both formal and non-formal approaches are essential in developing learning to know, be, learn and to live together, all related to SD literacy. Moreover, the big picture of the results points in the same direction and illustrates the importance of the recommendations provided by organisations and institutions such as UNESCO, the European Commission and The Council of the European Union about the role of formal, non-formal and informal approaches for ESD (European Commission, 2012; The Council of the European Union, 2018; UNESCO, 2017).

Regarding the formal approaches, time students had spent in the undergraduate program indicated a statistical difference for diversity, foresighted thinking, systems thinking, and normative competencies. This result was expected because PRME business schools are engaged in assessing, monitoring and incorporating sustainability into the formal curriculum as well as presenting sharing information on progress (SIP) about the educational activities related to sustainability (United Nations, PRME, 2020). However, it is interesting that time spent in a PRME business school itself did not ensure full development of sustainability competencies nor contribute to students' knowledge about SDGs, while the chosen major did contribute to closing this gap because business management courses equipped students with knowledge about SDGs and developed their normative competence. This might be an important finding, as authors identify economics and accounting as courses that struggle to incorporate sustainability into their formal curricula (Bradley, 2019; Mburayi and Wall, 2018); however, this assumption might hold true only for knowledge

Table 8.
Summary of hypothesis tests

Sustainability competencies and knowledge	FORMAL LEARNING		NON-FORMAL and INFORMAL LEARNING	
	Time in undergraduate programme	Chosen major	Engagement in student organisations	Working/internship experiences
Knowledge about SDGs	*H1b* Not supported	*H2b* Supported ($p < 0.01$)	*H3b* supported ($p < 0.01$)	*H4b* Not supported
Diversity	*H1a* Supported ($p < 0.01$)	*H2a* Not supported	*H3a* Supported ($p < 0.01$)	*H4a* Supported ($p < 0.001$)
Foresighted thinking	*H1a* Supported ($p < 0.01$)	*H2a* Not supported	*H3a* Not supported	*H4a* Supported ($p < 0.001$)
Systems thinking	*H1a* Supported ($p < 0.01$)	*H2a* Not supported	*H3a* Supported ($p < 0.05$)	*H4a* Supported ($p < 0.01$)
Normative	*H1a* Supported ($p < 0.01$)	*H2a* Not supported	*H3a* Not supported	*H4a* Supported ($p < 0.05$)
Action	*H1a* Not supported	*H2a* Not supported	*H3a* Not supported	*H4a* Supported ($p < 0.01$)
Interpersonal	*H1a* Not supported	*H2a* Not supported	*H3a* Not supported	*H4a* Supported ($p < 0.01$)
Strategic management	*H1a* Not supported	*H2a* Supported ($p < 0.05$)	*H3a* Supported ($p < 0.01$)	*H4a* Not supported
Number of items supporting the hypothesis	*4*	*2*	*4*	*6*

Notes: Category A1: students enrolled in the first two years; Category A2: students enrolled in the third year or later. Category B1: business administration students; Category B2: economics and accounting students. Category C1: students engaged in student organisations; Category C2: not engaged in student organisations. Category D1: students with working/internship experiences; Category D2: no working/internship experiences

about the SDGs and normative competence, while other competencies were not showed to be statistically different between business administration students and economics and accounting students. The authors believe this aspect needs further exploration in business schools that are not PRME signatories to determine whether the main difference between business management courses and those in economics and accounting concerns only knowledge about SDGs or also impacts SDCs. This difference is also explored by Elmassah *et al.* (2020), who identified statistical differences in the level of sustainability competencies between students from different majors or faculties.

From the perspective of non-formal education experiences, students engaged in student organisations showed higher levels of diversity, systems thinking, strategic management competencies and knowledge about SDGs. This result was expected because, in this specific business school, several types of student organisations are concerned with SD and are essential in generating dialogue with communities through extension activities and dealing with sustainability issues from the bottom-up (Borges *et al.* 2017a, 2017b).

Working and internship experiences, in turn, demonstrated the ability to develop most of the SDCs. This discussion is also present in the literature in which networking and real-world learning experiences are seen as essential for developing the required knowledge and SDCs (Brundiers *et al.*, 2010; Brundiers and Wiek, 2017; Remington-Doucette *et al.*, 2013; Salm *et al.*, 2010; Wiek *et al.*, 2014). However, despite this exciting result, it is worth considering that working experiences do not guarantee students will eventually act as sustainability change drivers, as although such experiences developed sustainability competencies, they did not indicate a statistical difference on knowledge regarding the SDGs (*learning to know* competency) (Elmassah *et al.*, 2020).

The findings also shed light on how HEIs can provide an effective learning environment for business schools towards ESD. Therefore, some pedagogical and classroom strategies can play an essential role in contributing to the hybrid learning approach in developing student's sustainability literacy and SDCs. In line with Pappas *et al.* (2013), the authors believe that professors and staff should go beyond the traditional lectures and adopt new classroom strategies to achieve the higher levels of Bloom's taxonomy (Bloom, 1956) by educating students capable of analysing sustainability challenges, evaluating possible solutions, examining information critically, creating desirable scenarios and designing a better future. Accordingly, pedagogical approaches in which students assume active participation in their learning process (McCabe and O'Connor, 2014) are likely to prepare students to become leaders concerned with SD (Kalamas Hedden *et al.*, 2017). For example, professors could conduct their classes by adopting problem- or project-based learning approaches (Kricsfalusy *et al.*, 2018; McGibbon and Van Belle, 2015; Wyness and Dalton, 2018). In addition, community service learning and place-based environmental education (Lozano *et al.*, 2017) are worth exploring alternatives for non-formal approaches once they could stimulate students' organisations to tackle real community and sustainability-related problems. Moreover, the importance of business schools in encouraging students' engagement in internship opportunities (e.g. sustainability or social internship programmes) seems to be one of the most effective ways in developing the SDCs through the informal learning approach (Meza Rios *et al.*, 2018; Miller *et al.*, 2021).

In sum, the results of this work can also benefit several stakeholders in the journey of pursuing sustainability in management education (Kurucz *et al.*, 2014; Starik *et al.*, 2010; Stead and Stead, 2010). First, policy-makers can use the results as evidence that a hybrid approach effectively develops SDCs and SD literacy among students. Second, PRME signatory business schools can re-think about its management teaching resources (Aragon-Correa *et al.*, 2017) in incorporating sustainability into their formal curricula (especially in

economics and accounting) and encourage students to engage in student organisations or to search for internship and working opportunities as complements to their formal education (Meza Rios *et al.*, 2018; Miller *et al.*, 2021). Third, researchers can continue developing relevant work involving a greater number of universities and students as well as investigating the role of other types of formal, informal and non-formal learning approaches play in developing future sustainability-driven leaders and managers who are capable of leading organisations towards a more sustainability-oriented state (Lozano *et al.*, 2015).

6. Conclusions

This paper aimed to explore whether formal, non-formal and informal learning experiences contribute to developing SDCs among students in a PRME signatory business school. The results revealed that students engaged in formal, informal and non-formal learning experiences during their undergraduate programme are more likely to develop all the SDCs and knowledge about SDGs. Therefore, it is argued that, individually, each learning approach is important to develop SDCs; however, a hybrid approach containing all three approaches could maximise learning and foster SD literacy among students.

This study has policy implications once it identifies a hybrid approach as the most effective in developing SDCs (The Council of the European Union, 2018; UNESCO, 2017). There are, at least, four educational policy implications that the business schools could undertake to overcome the monism and lack of interdisciplinarity through institutionalising a hybrid learning approach for ESD. First, the problem- and project-based learning approaches could provide sustainability knowledge and play an important role in developing in- and outside-class experiences that require students to tackle specific SD challenges. Secondly, more formal rules and educational policy enforcements from the Brazilian Ministry of Education to incorporate sustainability throughout the business management, economics and accounting curricula would help make the educational systems of business schools more sustainability-oriented. Third, as sustainability entails working with complex problems with different perspectives and challenges, assuming a multistakeholder perspective could lead business schools to develop the curriculum of its courses by promoting a generative discussion on the educational and pedagogical projects of business management, accounting and economic courses. Fourth, the formalisation of partnerships with public authorities and civil society (Borges *et al.*, 2017a; Menon and Suresh, 2020; Rogers, 2019) to solve social and environmental problems could act as an indicator of the quality of courses and would be a ground-breaking improvement in incorporating sustainability into PRME business schools.

Finally, this study has limitations that provide opportunities for future research. It is one of the first attempts to understand how formal, non-formal and informal educational experiences foster sustainability in a PRME signatory business school. It explores a single HEI within a particular culture and context. Future studies could adopt longitudinal analysis, investigate this research problem through qualitative approaches, assess students from different PRME signatory schools from different countries and compare those students to others at non-signatory institutions. The authors also encourage a deepening of the exploration through more quantitative analysis to understand the causality between independent variables related to SDCs and explore other categorical data types such as gender differences and the impact on learning experiences and the development of SDCs.

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Years in formal education		Kolmogorov-Smirnov[a] Statistic	df	Sig.	Shapiro-Wilk Statistic	df	Sig.
Diversity competence	Category A2	0.089	124	0.017	0.970	124	0.008
	Category A1	0.056	150	0.200*	0.984	150	0.075
Foresighted thinking competence	Category A2	0.094	124	0.009	0.969	124	0.006
	Category A1	0.072	150	0.057	0.978	150	0.016
Systems thinking competence	Category A2	0.074	124	0.0893	0.962	124	0.001
	Category A1	0.074	150	0.046	0.990	150	0.397
Normative competence	Category A2	0.080	124	0.0502	0.976	124	0.027
	Category A1	0.054	150	0.200*	0.988	150	0.231
Action competence	Category A2	0.110	124	0.001	0.943	124	0.000
	Category A1	0.068	150	0.091	0.975	150	0.009
Interpersonal competence	Category A2	0.083	124	0.034	0.953	124	0.000
	Category A1	0.086	150	0.009	0.973	150	0.005
Strategic management competence	Category A2	0.108	124	0.001	0.946	124	0.000
	Category A1	0.091	150	0.004	0.958	150	0.000
Level of knowledge	Category A2	0.200	124	0.000	0.872	124	0.000
SDGs	Category A1	0.161	150	0.000	0.916	150	0.000

Table A1. Normality test – years in formal education

Notes: * this is a lower bound of the true significance. a. Lilliefors significance correction. Category A1: students enrolled in the first and second years. Category A2: students enrolled in the third year onwards

Chosen major	Categories	Kolmogorov-Smirnov[a] Statistic	df	Sig.	Shapiro-Wilk Statistic	df	Sig.
Diversity competence	Category B2	0.055	124	0.200*	0.981	124	0.081
	Category B1	0.095	150	0.002	0.977	150	0.013
Foresighted thinking competence	Category B2	0.067	124	0.200*	0.977	124	0.035
	Category B1	0.087	150	0.007	0.981	150	0.037
Systems thinking competence	Category B2	0.080	124	0.052	0.976	124	0.026
	Category B1	0.056	150	0.200*	0.989	150	0.264
Normative competence	Category B2	0.073	124	0.100	0.981	124	0.077
	Category B1	0.062	150	0.200*	0.982	150	0.047
Action competence	Category B2	0.076	124	0.072	0.961	124	0.001
	Category B1	0.083	150	0.014	0.980	150	0.030
Interpersonal competence	Category B2	0.084	124	0.032	0.974	124	0.018
	Category B1	0.087	150	0.008	0.953	150	0.000
Strategic management competence	Category B2	0.102	124	0.003	0.954	124	0.000
	Category B1	0.082	150	0.016	0.976	150	0.011
Level of knowledge	Category B2	0.144	124	0.000	0.896	124	0.000
SDGs	Category B1	0.174	150	0.000	0.895	150	0.000

Table A2. Normality test – chosen major

Notes: * this is a lower bound of the true significance. a. Lilliefors significance correction. Category B1: business administration student. Category B2: other graduation majors

Students organisation engagement		Kolmogorov–Smirnov[a] Statistic	df	Sig.	Shapiro–Wilk Statistic	df	Sig.
Diversity competence	Category C2	0.057	175	00.200*	0.986	175	0.075
	Category C1	0.084	99	0.078	0.977	99	0.077
Foresighted thinking competence	Category C2	0.101	175	0.000	0.976	175	0.004
	Category C1	0.094	99	0.032	0.985	99	0.351
Systems thinking competence	Category C2	0.070	175	0.035	0.985	175	0.051
	Category C1	0.068	99	0.200*	0.981	99	0.163
Normative competence	Category C2	0.071	175	0.032	0.983	175	0.033
	Category C1	0.068	99	0.200*	0.985	99	0.343
Action competence	Category C2	0.064	175	0.081	0.970	175	0.001
	Category C1	0.112	99	0.004	0.976	99	0.073
Interpersonal competence	Category C2	0.086	175	0.003	0.962	175	0.000
	Category C1	0.082	99	0.095	0.975	99	0.057
Strategic management competence	Category C2	0.087	175	0.003	0.963	175	0.000
	Category C1	0.090	99	0.049	0.972	99	0.031
Level of knowledge	Category C2	0.161	175	0.000	0.913	175	0.000
SDGs	Category C1	0.204	99	0.000	0.867	99	0.000

Notes: * this is a lower bound of the true significance. a. Lilliefors significance correction. Category C1: students engaged in at least one year in student organisations. Category C2: students involved in less than one year in student organisations

Table A3. Normality test – students organisation engagement

Internship/working experiences		Kolmogorov–Smirnov[a] Statistic	df	Sig.	Shapiro–Wilk Statistic	df	Sig.
Diversity competence	Category D2	0.070	195	0.020	0.984	195	0.027
	Category D1	0.103	79	0.037	0.976	79	0.136
Foresighted thinking competence	Category D2	0.081	195	0.004	0.980	195	0.007
	Category D1	0.109	79	0.022	0.969	79	0.048
Systems thinking competence	Category D2	0.079	195	0.004	0.984	195	0.024
	Category D1	0.085	79	0.200*	0.984	79	0.424
Normative competence	Category D2	0.068	195	0.030	0.983	195	0.020
	Category D1	0.064	79	0.200*	0.976	79	0.150
Action competence	Category D2	0.074	195	0.012	0.972	195	0.001
	Category D1	0.135	79	0.001	0.960	79	0.015
Interpersonal competence	Category D2	0.098	195	0.000	0.961	195	0.000
	Category D1	0.085	79	0.200*	0.977	79	0.159
Strategic management competence	Category D2	0.106	195	0.000	0.955	195	0.000
	Category D1	0.121	79	0.006	0.958	79	0.011
Level of knowledge	Category D2	0.176	195	0.000	0.902	195	0.000
SDGs	Category D1	0.170	79	0.000	0.892	79	0.000

Notes: Note: * this is a lower bound of the true significance. a. Lilliefors significance correction. Category D1: Students with at least two years of working/internship experiences. Category D2: Students with less than two years of working/internship experiences

Table A4. Normality test – internship/working experiences

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