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Research Article

Promoting entrepreneurship in science education: Insights into curricular goals

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Abstract

This study aims to examine whether elementary science curricula can be combined with the teaching of entrepreneurship, based on the approach of Lackéus, which is considered an important point of focus for present-day education systems. Entrepreneurship is not commonly handled as an autonomous subject. According to relevant approaches, teaching entrepreneurship relies on certain competencies, knowledge, skills, and attitudes. This research aims to identify whether science curricula include these competencies and can assist in developing entrepreneurial qualities. The data for the research was derived from the science curricula of 16 different countries or regions. Findings showed that there are entrepreneurial competencies in the curricula examined.

Introduction

Over the last few decades, the topic of entrepreneurship in education has gained rising interest in the field of research. This came about as part of a greater revision of the role and principles of education in an effort to reconsider the ultimate role of teaching. This revision included the introduction of new perceptions such as the need for schools and education to promote learners' acquirement of skills and competencies rather than restricted the curriculum to content knowledge. Introducing Entrepreneurship as a subject in education structures is a complex reform, innovation, and approach which affects many levels and aspects of schoolwork [1]. This is the main reason why it is not easy to define this concept in a widely accepted form [2]. The EU's 2011 report attempts to sum up the concept by stating that entrepreneurship "refers to an individual's ability to turn ideas into action. It includes creativity, innovation, showing initiative and risk-taking, as well as the ability to plan and manage projects to achieve objectives" (p. 11).

Additionally, Stevenson and Jarillo [3]. Define entrepreneurship as "a process by which individuals - either on their own or inside organizations - pursue opportunities without regard to the resources they currently control" (p.23). In this respect, entrepreneurship is expected to have multiple benefits at varying levels. Firstly, at the level of the individual, since each person will have the qualities to appreciate the value of creativity and be more creative themselves, which would result in other positive outcomes like the promotion of skills such as observing and analyzing, or the promotion of attitudes such as higher confidence, cooperation, and interaction. Secondly, entrepreneurship can have benefits at the level of society as creative people will be more qualified to contribute to social progress, activities, and development. In any case, the promotion of entrepreneurship in education is considered a life-long learning and long-lasting commitment [4,5].

Incorporating entrepreneurship into education can be achieved at three different levels. The first level relates to education *about* entrepreneurship, where learners will be expected to gain a basic understanding of what entrepreneurship is about and its characteristics and value; this level emphasizes knowledge. The second level relates to education *for*

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entrepreneurship, where learners will be expected to gain the necessary qualities to be entrepreneurial; this level emphasizes skills and attitudes. The third level relates to education *through* entrepreneurship, a level at which learners will experiment. They will implement the knowledge, skills, and attitudes gained from the preceding two levels, thus becoming more familiar with the concept and process of entrepreneurship. As with every educational field, subject, institution, or activity, entrepreneurship education is affected by the environment but is also expected to contribute to it [6].

Literature review

The literature review of the particular study focuses on the basic topics that it negotiates, which will serve as a basis for it [7]. Therefore, it needs to include the ideas about entrepreneurship in education, with regard to its' theoretical points [5,6]. As well as its' practical, implementation strategies [4]. Furthermore, it needs to include the relationship between entrepreneurship and science teaching [5,6,8].

The fundamentals of entrepreneurship in education

Entrepreneurship is considered to be worth introducing into education systems as an interdisciplinary approach rather than an autonomous subject. This may be due to the nature and rationale of the concept; teaching entrepreneurship requires taking advantage of knowledge in an unprecedented way and using appropriate skills rather than referring to the content knowledge of a particular field of study. Entrepreneurship, no matter how it is defined, can be applied in many, if not all, subjects and fields of study. Any kind of knowledge gained from any subject can be used through the prism of entrepreneurship, as long as learners are committed to using it as a foundation to create values that can contribute to people's well-being. These values can vary in nature and can be social, cultural, or financial.

This approach implies that education should focus on promoting certain competencies to learners. Firstly, learners should appreciate the importance of using the knowledge, recourses, and means available to them in order to create. Secondly, they should be confident to create novel ideas or subjects, even if it involves careful planning, researching, experimenting, and even in some cases, risk-taking. Thirdly, learners need to identify gaps or fields where they can contribute, so they may identify what kind of novel creation is needed to provide meaningful change and satisfaction to the wider community in the near or distant future. All these competencies, which are foundations for entrepreneurship, can be achieved in different subjects with the appropriate teaching approach [4].

Lackéus [9]. Categorized the competencies that should be emphasized in entrepreneurship education into three different themes: knowledge, skills, and attitudes. Each theme is further divided into various subthemes Figure 1.

The theme of knowledge has three subthemes: Declarative knowledge encompasses the fundamental concepts and processes of entrepreneurship such as value creation, generation of ideas, promotion of creativity, search for opportunities, and accountability. Mental models encompass the knowledge of abilities to generate ideas and produce while estimating possibilities and risks. Finally, self-insight encompasses knowledge of the characteristics and personalities of entrepreneurs [4,10].

Skills have six subthemes. Learning skills related to learning activities while managing new situations and uncertainty. Strategic skills relate to arranging priorities, managing and developing vision, actions, and cooperation. Interpersonal skills relate to leading, promoting, motivating, cooperating, and resolving conflicts. Resource skills relate to creating, setting, and evaluating plans while identifying potential resources. Opportunity skills relate to identifying conditions that assist the promotion of ideas, production, concepts, and development of any kind. Finally, marketing skills relate to communicating the idea or product, disseminating, persuading, and creating appropriate excitement or feedback [4,11].

Attitudes have six subthemes: confidence and self-efficiency; passion, devotion, and self-awareness [11]. Innovativeness [12]. Proactiveness the motivation to dare [13]. The perseverance to deal with challenges [14].

All these themes have to be developed accordingly and simultaneously, as they combine cognitive and non-cognitive competencies. Knowledge competencies address learning *about* entrepreneurship. Skills address learning *for* entrepreneurship. And attitudes address learning *through* entrepreneurship [4-6].

The effective implementation of entrepreneurship education relies on meeting specific demands from the side of teachers, schools, and context. As with every educative approach, it needs to be accepted by the teachers, who should be willing, vigorous, open-minded, and flexible in order to adapt everyday experiences into hands-on activities for learners to engage in. Any knowledge, skills, or attitudes that teachers should transfer or help learners develop and obtain should first be sufficiently obtained by the teachers themselves. Teachers will be able to achieve this, provided that, in pursuance of broader contemporary pedagogies, they adopt the role of a facilitator, who helps learners construct knowledge and create and develop appropriate skills or competencies to become entrepreneurial. To begin, however, they must first be entrepreneurial themselves [4].

Teachers should be assisted in that direction by a supportive context, i.e., an educative environment. Any effort to implement innovative approaches in schools is highly unlikely to succeed if schools cannot accept and support them. This means that schools should provide teachers with the appropriate infrastructure, resources, and means to assist entrepreneurship sessions. They should give teachers the appropriate flexibility and potential to plan and implement activities that promote entrepreneurship, which may not be restricted to the classroom environment. Teachers should have the ability to plan and take advantage of the schools' intellectual capital so that they will deal with any challenge or shortage that might halt their work [15]. Unless these conditions are recognized and appreciated,

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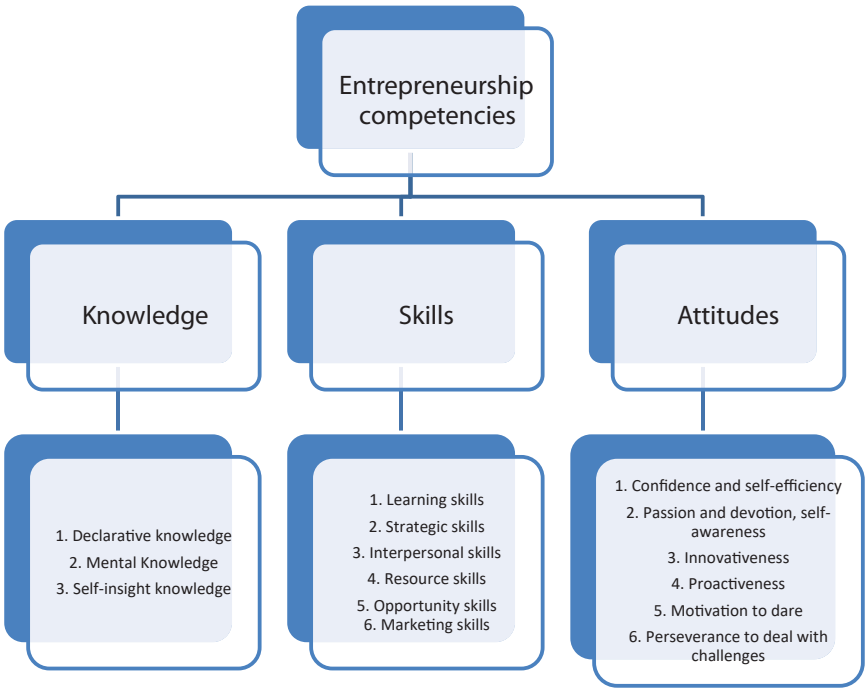

Figure 1: The competencies of Entrepreneurship by Lackéus (2014).

any effort to improve or reform schools, such as the effort to implement entrepreneurship, might not have substantial benefits for the educational system [2,16].

Activities and practices for entrepreneurship education

It is important to understand and highlight what distinguishes entrepreneurship education from other approaches. Certainly, any activity that aims to promote entrepreneurial attitudes should emphasize such qualities as problem-solving, authenticity, creation, the ability to deal with real-life situations, group work, valuable implementation of findings, and long-term development. However, these qualities are promoted by other teaching approaches as well, such as inquiry-based learning. Entrepreneurship, therefore, has to emphasize qualities beyond those.

In order to provide valuable contributions to the well-being and satisfaction of the greater community, entrepreneurial activities should exhibit certain qualities. One such quality would be the identification of opportunities, as these would define what new contribution needs to be created and promoted. Innovation is also important, as it would lead to the introduction of new ideas and concepts that have not been implemented in the past. Another quality is frequent experimentation with new ideas, which would lead to justification of the rationale of the new idea and its contribution, as well as its review and improvement over time. Finally, another important quality is risk-management. Learners who are expected to become effective entrepreneurs should be familiar with risk. They should be willing to take risks, understand their purpose, and know how to manage them effectively. Therefore, activities that qualify as entrepreneurial activities focus on the search for opportunities, innovation, frequent experimentation, and risk. Of course, all these are recommended to be better when included in hands-on activities, through which learners will also gain other qualities, such as cooperation, observation, and the ability to research and analyze and communicate and disseminate findings or ideas [16].

Entrepreneurship and science education

As entrepreneurship is entering the field of teaching through opportunities for integration, the focus is being given to research on the promotion of entrepreneurial knowledge, skills, and attitudes through different subjects, including science. In doing so, it is important to identify how the process of achieving the ultimate goal of science education, which is scientific literacy [17]. Can be made congruent with the achievement of entrepreneurship education goals. In other words, it is important to spot common points that science teaching and entrepreneurial teaching may share [18].

The process of benchmarking can help in that task. By comparing the research findings, policies, curricula, and education structures around entrepreneurship and science, it is possible to determine where they overlap. According to Deveci and Cepni [19]. This can be identified directly or indirectly, depending on the rationale of each policy, task, or activity. For example, there are policy documents and research projects that aim directly and deliberately to qualify learners as scientifically literate citizens and competent entrepreneurs at the same time. However, there might be policies, projects, or activities that have not been designed for that scope, yet provide relevant opportunities. This can be attributed to an extent to the complexity of both the fields of science education and entrepreneurship education. Indeed, each field is complex and is developed and studied across many dimensions. These might

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concern the teaching process and practices, the infrastructure, the instructional means, the teachers' role, the influence of policy, ideas and beliefs, legislation, school functions, and the compatibility of the school context [2,18].

Scientific literacy is a concept of dynamic nature. This means that there has been a number of definitions attributed to it. Perhaps the most accepted is the one given by OECD [20]. "*The capacity to use scientific knowledge, to identify questions and to draw evidence-based conclusions to understand and help make decisions about the natural world and the changes made to it through human activity*" (p. 10).

This definition, however, has been revised, elaborated, and refined. This led to a clarification outlining three basic competencies that scientific literacy emphasizes. A scientifically literate person should have the competency to explain phenomena scientifically, evaluate and design scientific inquiry, and interpret data and evidence scientifically. The first competency relates to content knowledge of scientific and technological topics and includes having the respective knowledge, stating definitions, or describing concepts, phenomena, and processes. The other two competencies go beyond knowledge of the subject matter. They address the need for learners to understand how the accepted scientific knowledge is constructed, approached, and verified. Compared to the first competency, they are more linked to skills and attitudes. These competencies have to do with procedural knowledge which refers to tasks, activities, and criteria that lead to new knowledge. Additionally, they are connected to epistemic knowledge, which has to do with the nature of science, as in what science and scientific knowledge encompass and why it is important. The main advantage of this approach is that learners can acquire a deeper understanding of science and its contribution to everyday life [17].

With these three competencies as guidelines for the promotion of scientific literacy, such literacy is expected to be achieved over time due to the emphasis on and development of eight basic practices. These reflect desired outcomes that learners need to master in school science. The first is the ability to ask questions about science issues and precise problems, and engineering issues. The second is to develop models and use them when necessary. The third is to be able to plan and carry out investigations. The fourth is to analyze and interpret data. The fifth is to use mathematical and computational thinking. The sixth is to construct explanations regarding science topics and design solutions, and engineering topics. The seventh is to engage in an argument with evidence and discourse. Finally, the eighth is to obtain, evaluate, and communicate information.

All these practices are expected to be developed together, for all students, with the development of appropriate skills, mainly through hands-on activities. These are recommended to be inquiry-based activities and tasks, where all students will work cooperatively on topics inspired by everyday life. It is commonly agreed that in teaching that aims to promote these activities, the active participation of learners is required [21].

In order to figure out how to combine science education and entrepreneurship education, it is necessary to see where the previously mentioned basic points of science education coincide with the points of entrepreneurship education.

Common points

A common point between teaching entrepreneurship and teaching science is the use of projects or inquiry. Indeed, inquiry-based activities can provide benefits in both subjects, as such activities promote the learners' engagement with a subject in order to devise a solution. In doing so, learners can identify a target, whether it is a creation, a problem, or a scientific question. They then have to plan the inquiry or research activity and come up with resources and activities to be accomplished. After that, they have to carry out their plan, in order to reach the preset target. Finally, they evaluate their work, revise it, and communicate it to various groups. This procedure is crucial for both science and entrepreneurship sessions. This common point can serve as an axis for identifying others, as each of its parameters and elements can also be a point of intersection for the two subjects.

In fact, the skills promoted, developed, or required in science teaching can coincide with those in entrepreneurial education, as is the case with plenty of other subjects as well. Skills such as observation, critical thinking, group work, communication, interaction, resource collection, and data collection and analysis are appropriate examples. In addition, specifically for science and entrepreneurship, experimentation and discourse are also important in both cases. Aside from skills, attitudes are also common. Both subjects require learners to develop the confidence to identify points to work on, design plans, test, proposed new ideas, and contribute. In short, it can be claimed that the cognitive and attitudinal goals are similar in both areas of study [6,8].

Common points in science and entrepreneurship teaching can be identified across the eight practices of science teaching. Both fields depend on asking questions and defining problems. In science, the questions should aim to identify explanations based on evidence, analysis, and appropriate investigation. These questions will serve as the main axis of the inquiry activity. In entrepreneurship, there should be a question that will cover or reflect a problem to be resolved. This problem will probably require some sort of invention or creation of innovative ideas and will highlight the work of the learners, as in the case of science. In order to answer the question or solve the problem, the learners will have to cooperate to design activities, collect data, and exchange ideas.

Developing and using models is also necessary for both science and entrepreneurship. These models might be diagrams, graphs, replicas, representations, or computer simulations. In science, these models will represent systems or phenomena. They are approximate representations of the real world or specific parts or processes of it. They explain or describe how such and such work and function, and have to be based on evidence. Furthermore, they have to be useful, which means they should be applied in various contexts and help learners make hypotheses and predictions or calculations [21].

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Similarly, in entrepreneurship, models might be necessary as they help in the design, construction, and management of the creation and identify strong points as well as points that call for improvement. They can also be used for testing or performance where possible [5,6].

Additionally, the process of planning and carrying out investigations is important in both fields. In science, an investigation might focus on understanding a phenomenon, testing a theory, or evaluating a model [21]. In entrepreneurship, it might help devise the idea for a concept or object that does not exist but could help the wider community. Therefore, investigation can help learners decide what to create and how to achieve and justify it. The investigation is not a simple process. It should have a specific goal, possible desired outcomes, and precise actions which are based on data collected and analyzed through experimentation, evaluation, and discourse. Over time, learners should become more familiar with the process of investigation, its requirements, and its contribution to scientific learning and entrepreneurial tasks [18].

Analyzing and interpreting data is another common point between the two fields. In science, the task of collecting data to identify patterns is of central importance. As part of understanding what science is and how scientists work to approach knowledge, learners should learn to collect data and organize and analyze them through various methods, such as graphs or statistics (Driver et al., 2006) [21]. In entrepreneurship, learners should use data as it can be used to justify their decisions and actions. Aside from that, it helps to evaluate the progress and effectiveness of their work or creation. In both science and entrepreneurship, learners should become accustomed to various ways of analyzing and presenting data as evidence to support their ideas, hypotheses, predictions, findings, and conclusions [5,6].

In addition, mathematics and computational thinking are useful for both science and entrepreneurship. Science is related to mathematics, as learners can use it to make calculations when they identify the relationships between concepts and phenomena. Thus, they can be involved in experimentation, data gathering, analysis, hypothesis formation, communication, and prediction [21]. Computational thinking can also be used in measuring, observing, and managing data, whether quantitative or not. The benefits are similar for entrepreneurship, as by using mathematics and computational thinking, learners can collect and analyze data and draw conclusions about what they should create and promote. In short, mathematics and computational skills can help learners gain a better understanding of patterns and make more accurate decisions, which is crucial for hands-on activities [4-6].

At the same time, constructing explanations and designing solutions is important for science as well as entrepreneurship. Science as a human activity is highly associated with constructing explanations, and so is science teaching. These explanations serve as answers to scientific questions and can demonstrate how variables or sets of variables relate to each other. They are formed after investigation and the analysis of data, and they are used to construct the desired science theories [22]. In the same way, entrepreneurship relies on designing solutions, which will lead to creating new products, ideas, or values. This design should be based on ideas and hypotheses, which include determining what is required, how the desired creation should be, what criteria and conditions it should satisfy, and how it can be generated [4,16].

In short, the literature review supports the idea that there are some common points between the teaching of science and entrepreneurship. An effort to benchmark science literacy approaches [6]. And the competencies of Entrepreneurship by Lackéus [9]. Presents this conclusion, albeit in more detail. About knowledge, both entrepreneurship and science focus on delivering new, accurate knowledge and conclusions about everyday life phenomena, justifying them, and implementing and applying them. With regards to skills, both entrepreneurship education and science teaching focus on learning skills, experimentation, trial and error, observation and monitoring, identifying resources, analyzing data, drawing conclusions, and promoting and communicating findings and ideas. Finally, both entrepreneurship and science teaching relies on the development of appropriate attitudes. Learners need to treat both topics as important, understand their methodology and patterns, and engage with activities around them in order to understand and contribute. Confidence, motivation, dealing with challenges, and proactiveness are important attitudes and virtues that learners need to adapt, develop, and demonstrate in both areas [4,16,22]. In any case, effective education in both entrepreneurship and science relies on foundations such as active engagement of learners in activities that emphasize everyday life contexts and situations [5,6,8]. With that in mind, it is possible to identify goals, units, and points in science curricula that might be compatible with entrepreneurship teaching. The research on this concept to date is limited. This is the actual goal of this study.

Research methodology

With all the above mentioned in mind, this particular research was planned. The research aims to point out whether elements of teaching entrepreneurship can be traced in elementary science curricula. In order to do so, the research focused on identifying whether science curricula emphasize the competencies of Entrepreneurship, as described by Lackéus [9]. Knowledge competencies can be basic concepts about entrepreneurship. It can also be mental and address modes of generating ideas and self-insight. Skill competencies might relate to learning skills, strategic skills, interpersonal skills, resource skills, opportunity skills, and marketing skills. Attitude competencies have to do with confidence and self-efficiency, passion and devotion self-awareness, innovativeness, proactiveness, motivation, and perseverance to deal with challenges. These competencies can be promoted through the learners' active engagement in the teaching process with hands-on activities that aim to convert an innovative idea into an output. These activities can include group work, experimentation, observation, critical thinking, searching for resources, hypothesizing evaluation, trial and error tests, brainstorming, and self-reflection. Such tasks and values are compatible with the inquiry-based learning approach [5,6,8,16].

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In science education, the approach of inquiry-based teaching is considered appropriate and necessary in contemporary literature. Through inquiry, observation, hypothesizing, experimentation, discourse, brainstorming, developing models, critical thinking, and several similar practices, learners are expected to understand and decide on issues concerning the natural world. Along with that, science teaching is expected to be effective when emphasizing tasks from learners' everyday context and experience. For that reason, they can effectively conceive and reach the goals of scientific literacy. Therefore, science teaching and entrepreneurship teaching can have various common points. It can be expected that science curricula will entail goals and elements that will simultaneously assist the teaching of entrepreneurship, as has been well stated by the current literature [5,6,8,19,22]. Nevertheless, the research investigating whether science curricula actually involve aspects of teaching entrepreneurship seems to be limited. The goal of this study was to conduct such an investigation.

In order to conduct the investigation, the curricula of different countries were collected. The selection was based on the criteria of availability, accessibility, and the possibility to be analyzed. Specifically, the research investigated primary science curricula that could be accessed online for free. The curricula of 16 different countries or states were collected and analyzed. These were Australia; Ontario, Canada; Quebec, Canada; Cyprus; France; Greece; India; Ireland; Malta; Nepal; New Zealand; Norway; South Africa; Sweden; and the United Kingdom. Thus, the research can be classified as a content analysis study [7,23-25].

In order to identify whether elementary science curricula actually contain elements that promote entrepreneurship teaching, three research questions were formed. These questions were based on the approach of Lackéus [9]. Regarding the competencies of entrepreneurship:

1. Do the elementary science curricula include the construction of knowledge for entrepreneurship?

2. Do the elementary science curricula include the development of skills for entrepreneurship?

3. Do the elementary science curricula emphasize the adoption of attitudes for entrepreneurship?

By answering these questions, it is possible to draw insights into the possibility of promoting entrepreneurship through science curricula. The research is of a quantitative nature and is an example of document analysis. In such a study, data from document resources need to be gathered, organized, understood, summarized, and interpreted, so that further conclusions can be drawn from them [26,27]. When conducting document analysis, there are specific steps that need to be followed carefully. The first step is the collection of the documents. The second is coding, which involves deciding what codes are relevant to the topic and the research questions. These codes can be units, texts, words, or phrases. Along with the codes, the categories of codes need to be addressed as well. Afterward, the documents will be thoroughly examined in order to see how often these codes and categories emerge. Finally, the values of descriptive statistics will be calculated to produce the findings [23-25].

The codes and the categories were designed based on the model of the competencies of entrepreneurship [9]. The first category was "knowledge", which is linked to the first research question. This included the code "declarative" for units that are related to what entrepreneurship is and what it consists of. It also included the code "mental" for units relevant to converting ideas into outputs. Lastly, it included the code "self-insight" for units that were about reflection and evaluation. The second category was "skills," which is linked to the second research question. This included the codes "learning," "strategic," "interpersonal," "resources," "opportunity," and "marketing," which addressed units that related to the relevant skills. The third category was "attitudes," which is linked to the third research question. This included the codes "confidence and self-efficiency," "passion and devotion self-awareness," "innovativeness," "proactiveness," "motivation," and "challenge-dealing," which would be attributed to units that related to these attitudes. The texts of the curricula were read and coded as planned. Afterward, the codes and categories were gathered and the absolute and relevant frequencies for the codes and categories were calculated so that analysis could be conducted. Thanks to the use of SPSS, it was possible to calculate the further values of descriptive statistics, such as the means and medians. This helped gain the desired findings which could then lead to discussion and conclusions [7,23-25].

Findings and discussion

Regarding the first research question, the science curricula of the sample countries included codes, goals, expectations, and generally various elements regarding knowledge around entrepreneurship or how entrepreneurs work, as seen in Table 1. These codes usually address developing skills, such as observation, trial, and error, selecting resources, experimenting, and hypothesizing, which would usually relate to the category of mental knowledge [9]. Simultaneously, some codes addressed adopting positive attitudes towards identifying challenges, carrying out inquiry-based research, experimenting, and drawing conclusions, which would relate to the category of self-insight [5,6,8,9,19,22]. On the other hand, codes that related to the declarative knowledge of entrepreneurship were not identified in all the examined curricula. Only some included goals related to knowledge of what entrepreneurship is. For example, in certain countries, learning to explore and engage in activities around creativity, as well as its importance of it were mentioned in the core curriculum. Such codes that can be linked to declarative knowledge were rather less frequent [6,8,9]. In short, as concluded from the documents investigated, science curricula can entail goals that relate to knowledge about entrepreneurship, however, they address mental and self-insight knowledge more. They might also address declarative knowledge, but this does not seem to be common [6,9,22].

With regards to the second research question, the science curricula studied included notes that related to

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Table 1: Frequencies and relevant frequencies of codes.

Competencies	Frequency	Relevant frequency
Knowledge		
Declarative	8	50%
Mental	16	100%
Self-Insight	16	100%
Skills		
Learning skills.	16	100%
Strategic skills.	16	100%
Interpersonal skills.	16	100%
Resource skills.	16	100%
Opportunity Skills.	6	37.5%
Marketing Skills	4	25%
ATTITUDES		
Confidence and Self-Efficiency	16	100%
Passion and Devotion Self-Awareness	16	100%
Innovativeness	8	50%
Proactiveness	10	62.5%
Motivation to Dare	16	100%
Perseverance to Deal with Challenges	16	100%

entrepreneurship skills. In other words, skills that were stated as being helpful for entrepreneurship were simultaneously considered useful for science teaching and developing scientific literacy as well [5,9,22]. This is the case for certain types of skills, in particular, namely, learning, strategic, interpersonal, and resources skills. These skills were identified in the codes of all of the curricula studied. Indeed, the contemporary approach of inquiry-based science teaching which is implemented relies on the development of such skills [6,22]. And it is within the same content that they can promote entrepreneurship skills and education generally [4,9]. However, codes that relate to opportunity and marketing skills could only be retrieved in certain curricula, not all. Even in these science curricula, for example, those of India and Norway, it was identified that these skills can be related to qualities that learners might need in their professional life. This, in turn, can be linked to the field of entrepreneurship education [5,9]. In short, science curricula can emphasize skills that promote entrepreneurship. This applies especially in cases where inquiry-based science teaching is an aim. Among the entrepreneurship competencies, those usually identified in science curricula are learning, strategic, interpersonal, and resource skills [5,6,8,9,19,22].

The findings concerning the third research question are similar. As with knowledge and skills, a significant number of codes regarding attitudes were spotted in the science curricula of the study. This means that there are certain entrepreneurship-friendly attitudes that curricula consider as important for the acquisition of scientific literacy. Most codes were in regard to attitudes such as confidence and self-efficiency, passion and devotion self-awareness, innovativeness, the motivation to dare, or the perseverance to deal with challenges [9]. These codes were spotted mostly in parts of the science curricula that focused on the inquiry-based teaching approach. Indeed, if science is to be taught through inquiry, all these attitudes are essential. Therefore, they should be developed and implemented [6,8,19]. The codes of innovativeness and proactiveness were identified as well, but only in certain curricula. It is probably not a common belief that these two types of attitudes should be priority goals for science teaching, according to contemporary approaches. However, these attitudes were noted in some curricula. This implies that it is possible to have a connection between these skills within science teaching. In fact, the specific curricula mentioned these attitudes when emphasizing identifying solutions, problem-solving, and dealing with challenges. Probably, there are contexts where these attitudes are given higher priority in science teaching, in comparison to others. After all, the goals of science teaching might be influenced by the context [6,8,19,22].

As understood from the findings, in general, science curricula are likely to include goals relating to knowledge, attitudes, and skills which are the competencies required for teaching entrepreneurship [9]. The knowledge can address topics such as how to generate ideas and turn them into conclusions and findings, or how the scientist or entrepreneur works. The skills can relate to learning, developing strategies, interpersonal aspects, and resource management. Lastly, the attitudes might relate to confidence and self-efficiency, passion and devotion self-awareness, innovativeness, the motivation to dare, or the perseverance to deal with challenges. All these competencies are considered important for the implementation and engagement of inquiry-based science teaching. Therefore, the hypothesis, formed through previous literature and studies, that this approach is a common point between science and entrepreneurship teaching is justified [5,6,8,19,22]. However, certain competencies do not seem to be identified in all the science curricula studied. An example is a declarative knowledge which addresses the exact nature of entrepreneurship. This is also the case with skills such as opportunity skills or marketing skills, or attitudes relating to proactiveness or innovativeness. Apparently, in some contexts, these competencies are considered by the curriculum designers to suit the goals of science education and the development of scientific literacy [5,8]. Instead, these competencies are strictly focused on entrepreneurship [9,16,19].

Conclusion

The scope of this research was to examine whether elementary science curricula can promote aspects of entrepreneurship education. Teaching entrepreneurship is considered very important for contemporary schools and citizens, as it is justified to have significant benefits at personal and social levels. Teaching entrepreneurship appropriately relies on hands-on activities, with the active engagement of learners who are expected to create, convert ideas into products or services, and appreciate the value of this ability. However, it is claimed by researchers and theorists that entrepreneurship has not yet been properly implemented in teaching [3,4,6,13]. Lackéus [9]. Has pointed out certain competencies that entrepreneurs need to gain, comprising knowledge, skills, and attitudes. Since entrepreneurship is not yet an established autonomous subject, it is possible to qualify learners with these

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competencies by approaching entrepreneurship through other fields of study. According to research, science may be a subject that can promote entrepreneurship as education for both science and entrepreneurship may have common points. The teaching model of science through inquiry-based activities is found to be relevant to entrepreneurship teaching. The reason for this is that this mode engages learners to implement inquiry-oriented tasks, construct knowledge, and learn from hands-on experience [8,19,22]. Even though the relationship between the teaching approaches of both science and entrepreneurship has been examined, there is limited research on whether there is currently any actual effort to combine these two fields in implemented teaching.

With all this in mind, this research was planned to examine whether it is possible to find common points that helped promote the competencies of entrepreneurship in science education curricula, which include the goals, theories, and rationale of science teaching [17,18]. For the scope of the research, the curricula of 16 different countries or regions were gathered. The selection criteria were the language and accessibility. Document analysis was then implemented [7,25]. Analysis was based on coding. It was decided that the appropriate codes would be the necessary competencies of entrepreneurship teaching [9]. The curricula were read and coded in order to identify whether entrepreneurship competencies codes existed within them. The findings showed that the curricula studied included codes that addressed knowledge, skills, and attitudes relating to entrepreneurship. These codes were found in parts of the curricula that emphasized inquiry-based science teaching, as supported by the literature [6,8,19,22].

Prior to generalizing these conclusions, it is necessary to stress certain limitations. It would be interesting if, in the future, further similar research was carried out to evaluate and strengthen the accuracy and generalizability of these outcomes. Such research could include studies of a wider range of science curricula. Apart from that, it would be interesting if the outcomes were triangulated with data deriving from other resources such as interviews with teachers or policymakers. A final limitation is that this paper was based on a particular approach to teaching entrepreneurship [9]. Perhaps in the future, further research can take into consideration other approaches [7,23-25].

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