



Education for Sustainability: Teacher Professional Development Training Program in Green Entrepreneurship - A Systematic Literature Review

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Abstract. Providing entrepreneurial experience to have an interest in becoming a young entrepreneur is the success of vocational schools, but it will be very valuable when schools are able to foster green entrepreneurship as a step to save the environment from damage and achieve sustainable development. This study aims to describe a conceptual model of developing teacher professional training to foster green entrepreneurship through a virtual professional learning community. The research method used a systematic literature review of 26 relevant articles indexed by Scopus in the 2014-2024 time span. The research found that the conceptual model framework in the virtual training of essential entrepreneurship teacher professional development program involves objectives, methods, resources, partners, duration and digital media. The professional development training with the theme of green entrepreneurship focused on environmental issues, green innovation, teaching in green entrepreneurship, and best practices or projects. The training is required to prepare facilities, establish a virtual professional community, implement and evaluate. The findings implied that educational institutions should be able to provide activities to increase environmental awareness in the entrepreneurial process that can encourage solutions to environmental, social and economic problems to support sustainable development goals.

Keywords: Entrepreneurial Experience, Sustainable Development, Green Entrepreneurship

1 Introduction

The development of entrepreneurship has recently changed rapidly as a result of the industrial revolution 4.0. The goal of making profits through entrepreneurial activities is the top priority. However, there is a paradigm shift, the importance of implementing green entrepreneurship refers to the awareness of achieving a balance between profitability and environmental responsibility [1], such as the use of environmentally friendly inputs, clean manufacturing processes, waste management, recycling, and so on [2]. Green entrepreneurship as a solution to various social and environmental problems through creative ideas of green goods so as to protect nature if realized jointly by the community [3]. Education plays an important role to introduce green entrepreneurship to find out the factors both theoretically and practically in order to develop green entrepreneurship programs for students [2]. This is known as Green entrepreneurship education, as a way of promoting green entrepreneurship is expected to foster talent and interest for students [4]. Internalization of green entrepreneurship in education in Indonesia is a concern and leads to students' interest in becoming green entrepreneurs [5], through embedding syllabus with green entrepreneurship aspects [6], increasing awareness and knowledge of green entrepreneurship in learning [7]. Thus, the implementation of entrepreneurship education in Indonesia at least supports the green entrepreneurship campaign that can be provided through the entrepreneurship learning system. Green entrepreneurship activities as an effort to support in achieving SDGs in 2030 [8].

Although, green entrepreneurship has become a concern in the educational environment but in practice there are still obstacles including, only students who have high environmental values generate positive attitudes towards green entrepreneurship and students who do not have environmental concerns have low interest [5]. This is due to the limited availability of resources and lack of integration in the entrepreneurship education curriculum [6]. On the other hand, the low interest in green entrepreneurship is caused by concern for the environment that is not owned in students to be a barrier. The lack of environmental awareness is caused by limited school support in fostering the movement to pay attention to the environment for various aspects of education [9].

This study aims to see that the role of teachers to install green entrepreneurship which can be achieved by integration in teacher training programs and forms of green entrepreneurship education [10]. Researchers in the field believe that the role of educators to instill green entrepreneurship promotes sustainable education through paradigm transfer in teaching so as to form a sustainable lifestyle [11], [12]. Of course, teachers not only transfer knowledge in entrepreneurship education, but are also expected to act as entrepreneurs who pay attention to the environment in the end towards sustainability [13]. Both theoretical and practical mastery by teachers in green entrepreneurship is important because it supports its application in schools to teach students. Thus, there is a need to examine the cultivation of green entrepreneurship to form interest and habits in green entrepreneurship which ultimately supports the achievement of sustainable development in education [14].

The entrepreneurship teacher training model can be provided through a professional teacher development program that integrates green entrepreneurship into teaching according to current student needs. The quality of teacher professional development can

examine topics including, green entrepreneurship, values, attitudes, knowledge, and skills of green entrepreneurs in supporting sustainability, environmental issues, [12], [14], [15]. Teacher professional development training is established to gain both theoretical and practical experience in green entrepreneurship materials [15]. One of the programs that can develop teacher professionals in professional learning communities is through the Lesson Study method. Lesson Study is a method that can be used to develop teachers in teaching starting from the process of planning, teaching, observing and providing feedback as an improvement [16]. This lesson study is provided in the form of a Virtual Professional Learning Community (PLC), conducted by collaborating with entrepreneurship teachers virtually as a consequence of growing digitalization [17] so that they can find effective strategies in teaching, especially embedding green entrepreneurship education in vocational schools [18].

While there is great interest in the field of education to teach green entrepreneurship to teachers and students in schools, the reality is that there is a limited amount of research that addresses teacher professional development in relation to the introduction of green entrepreneurship in schools [19], [20]. Previous studies did not detail the main studies in the design and guidelines of teacher professional development training activities, they only revealed the impact of teacher professional development on students' entrepreneurial interest and teacher confidence [20], as well as the impact of entrepreneurship education teacher development training without reviewing green entrepreneurship [19]. This condition shows a gap that requires the sustainability of teacher professional development training programs so as to achieve green entrepreneurship education in schools effectively [20]. Of course, this cannot be separated from integrating the secondary education curriculum and providing teacher professional development training programs related to practical learning of environmentally responsible entrepreneurship or green entrepreneurship [21]. This research aims to develop a conceptual model framework in teacher professional development program training activities that provide green entrepreneurship practices using the virtual professional learning community method and provide new contributions in addressing green entrepreneurship initiatives in schools today.

2 Method

This research study uses a literature review to synthesize articles that have been published on a particular theme so that a new perspective is found [3]. The integrative literature study consists of five stages including: formulating research problems, collecting relevant previous research, evaluating the collected research results, analyzing data and presenting relevant research findings [4]. Analysis of scientific articles on the topic of green entrepreneurship and teacher professional development and Virtual Professional Learning Community. This analysis aims to develop a conceptual model framework in teacher professional development program training activities that provide green entrepreneurship practices using the virtual professional learning community method. Some of the published journal articles come from Google Scholar, Scopus databases such as Emerald, Elsevier, Springer, and Sage Journals. Some articles also come from international proceedings that are included in the Scopus database. The keywords

used were “green entrepreneurship”, “green entrepreneurial student”, “entrepreneurship education”, “virtual professional learning community (VPLC)”, “teachers’ professional development (TPD)”, “sustainability entrepreneurship education”. The literature review search was conducted from March to May 2024. The following article search and selection process is presented in Figure 1.

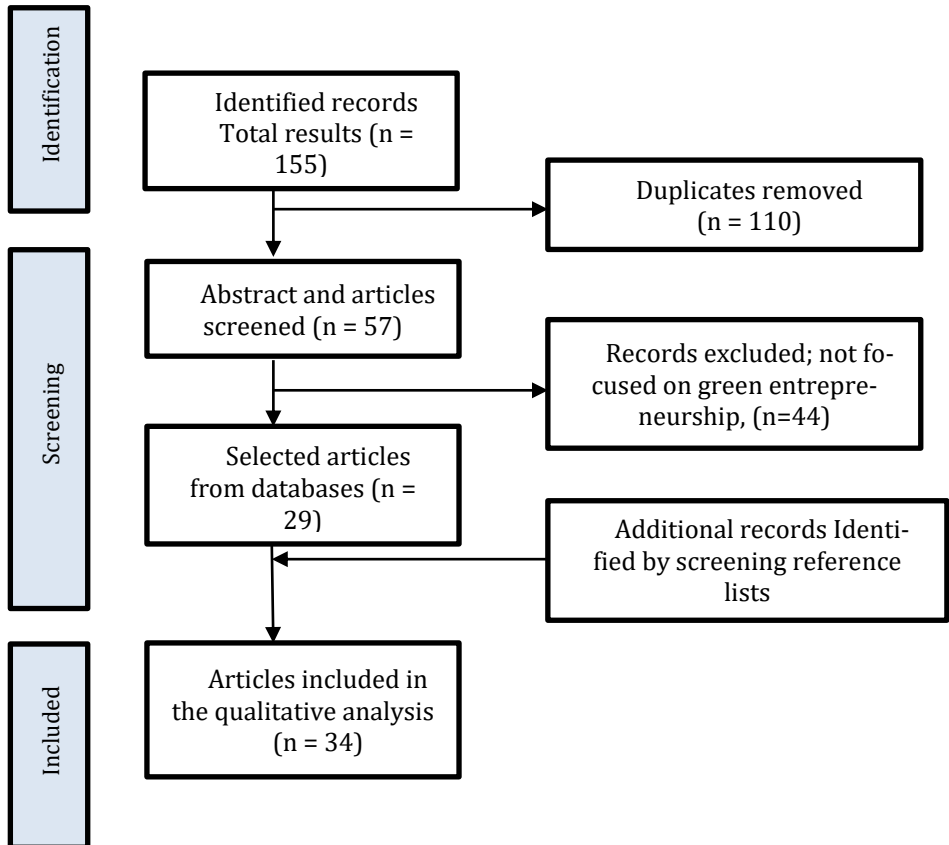


Figure 1. Article search and selection process

The search found 155 articles on green entrepreneurship education, Virtual Professional Learning Community, and Teachers’ Professional Development. Filtering again resulted in $n=110$ articles that had duplicates. Further screening in title and abstract resulted in 57 articles. Some were excluded from the literature review because they did not focus on green entrepreneurship education, PLC and TPD. Reselection of articles from the database resulted in 29 relevant articles. In addition, a snowball technique was used by selecting some of the references used from the articles that had been selected as many as 5 articles and resulted in 34 articles to be analyzed qualitatively according to relevance in this study. Some articles were excluded because (1) the technical terms

of entrepreneurship but not the focus of the article were related to green entrepreneurship, or related to Virtual Professional Learning Community, or related to teachers' professional development, (2) the article was not in English, (3) part of the text was incomplete, and (4) the article was still in the review process and had not been published.

3 Results and Analysis

3.1 Key characteristics of teacher professional development training in green entrepreneurship

The findings of the characteristics of the green entrepreneurship-themed teacher professional development program can be seen in Figure 2. These important elements are presented as the basis for implementing the training so that the objectives can be achieved effectively.

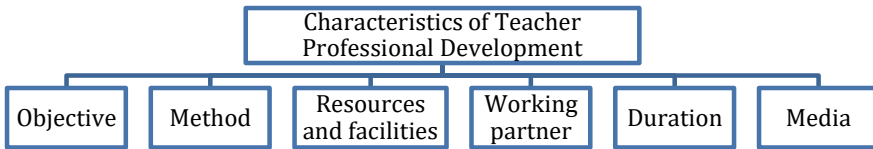


Figure 2. The Main Characteristics of Green Entrepreneurship Professional Teacher Training

Teacher professional development training programs are provided in order to develop themselves to improve the quality of education quality [22], [23]. Based on the literature review, the main characteristics of teacher professional development training initiatives include: a) objectives, b) methods, c) resources and facilities, d) partners, e) implementation time, and f) technology platform [22], [24], [25], [26]. Next, we discuss the characteristics of teacher professional development training programs according to the literature review: First, the purpose of teacher professional development program training is to provide good practices from teachers' experiences [27]. This activity provides teachers with pedagogical knowledge as well as practical experience in specific cases. In the context of this study, teachers' professional development is focused on green entrepreneurship which they can later apply to entrepreneurship learning classes [23].

Second, teacher professional development programs are delivered through teaching methods such as case study delivery [23], entrepreneurial dimension projects [24], and active participation such as conducting feedback, and creating new teaching innovations. Teachers' active participation in the training can trigger meaningful learning as they give opinions to each other, their practical experiences in the classroom and their difficulties can be identified [28]. Teachers can be directed to design green entrepreneurship lessons in the classroom that are oriented towards exploring students' creative

ideas. This kind of learning can provide understanding until green entrepreneurial intention increases [29], [30]. Third, resources and facilities and school support in teacher development training activities are taken into consideration to achieve effective goals [31]. The principal's support in the professional development of entrepreneurial teachers is a key factor that motivates teachers to apply what they have learned during professional training [32], [33].

Fourth, professional teacher training and development can be carried out through cooperation among entrepreneurship teachers. Cooperation between teachers can be done with the Professional Learning Community (PLC) approach both within schools and between schools because it can improve teacher professional development [34]. PLC provides opportunities for teachers to share knowledge, good learning practices, and experiences, as well as reflect and learn to collaborate professionally [35]. In addition, collaboration is not only collaboration among teachers but also from various parties such as scientists or researchers, in this case university institutions. Universities play a role in terms of preparation, implementation and evaluation of professional development, for example, lecturers provide teaching practices to teachers to access empirical research findings on teacher professional development [36] which are linked to the understanding of green entrepreneurship. Collaboration between teachers and other parties such as scientists is a major pillar in teacher professional development, especially when the two agencies work together to realize quality education [37]. A synergized environment for collaboration shows the ability of teachers to take real action in their practical understanding when experiencing obstacles to practicing green entrepreneurship in learning [38].

In addition to institutional support from universities, partner support can also be done with government agencies, industries and organizations to increase the understanding and practice of green entrepreneurship in the educational environment [39]. Teaching-learning experiences show that addressing real local business problems collaboratively and adopting principles of shared knowledge creation can lead to sustainable solutions and experiential learning and contribute to transforming society towards sustainability [40]. Higher government support usually corresponds to an environmental orientation for entrepreneurial practices especially in educational settings, even to the point of providing incentives to spur environmentally friendly products in entrepreneurial practices [41]. Industry cooperation can be found in the form of visits from successful entrepreneurs to classrooms can help students make valuable industry connections in preparing students to start their own green ventures [15].

Some professional development activities are usually carried out for 20 hours or more time required, or can also be carried out for one semester [32], [36]. Entrepreneurship projects require time to work on the design and innovation of entrepreneurship teacher learning so that it needs to be considered in training for effective implementation. Sixth, digital platforms are highly recommended nowadays because they facilitate the practice of designing lessons, exchanging ideas among teachers and facilitators, and training methods as well as end-of-activity assessments [36]. This technology platform in training practice can be used to improve the monitoring of program achievement [32]. The use of digital tools is also useful in technical implementation, viz: use of videos from teachers' classrooms, videos to

analyze resources, fictional animations to complement videos, structured digital learning works, hybrid teacher collaboration, and digital teacher collaboration [18].

3.2 Suggested Green Entrepreneurship Training Curriculum in teacher professional development training programs

In this section, we will discuss several topics of green entrepreneurship training curriculum in teacher professional development programs. Green entrepreneurship topics are closely related to theoretical understanding and then developed into practical steps that are useful in honing teachers' skills. Table 1 provides some key components to be included in the green entrepreneurship curriculum for teacher professional development training.

Table 1. Green entrepreneurship training curriculum design topics

Topics	Discussion Review
The basic concept of green entrepreneurship	Understand the basic concepts, principles and importance of green entrepreneurship. [7], [42]
Environmental and Sustainability Issues	Understand environmental issues and the importance of sustainability as a background for green entrepreneurship. [40], [43]
Green Technology and Innovation	Technology to support green entrepreneurship such as waste treatment technology, product design to reduce environmental impact [44], [45]
Education and Pedagogy	Develop teaching methods and integrate green entrepreneurship as well as learning evaluation. [46], [47], [48]
Government regulation of the environment	Understand various government regulations and policies related to green entrepreneurship [49]
Partner collaboration	Build collaborative partnerships with fellow teachers, alumni, organizations, other educational institutions, industries and MSMEs (micro/small/medium enterprises) to find alternative solutions to green entrepreneurship practices. [29], [50]
Case studies and best practices	Successful green entrepreneurship case studies, green entrepreneurship projects in schools for recycling, organic school gardens [51]
Design a project	Design green entrepreneurship projects, managing up to environmental and social impacts [52], [53]
Leadership and advocacy	Leadership encourages a culture of sustainability in the school and promotes it throughout the school community. [54]

Some green entrepreneurship topics can be integrated in learning and teacher professional development training. Empirical research results show evidence that entrepreneurship education and training has a positive effect on environment-based entrepreneurship skills [55]. The inclusion of environmental and sustainability issues in green

entrepreneurship education and training programs is able to promote a green entrepreneurial mindset and acquire green business activities [56].

3.3 Conceptual Model of Green Entrepreneurship Teacher Training through Virtual Professional Learning Community

It has been discussed teacher professional development training and its important components as a basis for embedding green entrepreneurship among teachers. Consideration of the curriculum focus and teaching methods in professional development training is important for effective training [57]. However, effective training development does not focus on content alone but also focuses on pedagogy so as to improve classroom teaching on a large scale. This research uses the Professional Learning Community (PLC) approach. Professional Learning Community is a form of collaborative practice that brings professional development initiatives in schools to improve teaching and learning and pedagogy through sharing experiences of professional practice [34]. The use of video conferencing and even asynchronous text discussions can facilitate teachers' PLC or in this study it is abbreviated as virtual Professional Learning Community (VPLC). Teachers who collaborate collectively in a VPLC can engage in deep reflection and ongoing collaboration with colleagues from different parties. Success in this activity depends on a combination of responsiveness to other teachers' support, encouragement, active interactive engagement and discussion in PLC activities [58]. Continued member participation is also an important aspect in achieving effective activities [59].

Now, focusing on the characteristics of PLCs, [60] divided into three clusters: i) individual and collective learning consisting of collaboration, reflection, giving and receiving feedback and experimenting; ii) dynamic group characteristics where members trust and respect each other, support colleagues and social cohesion can occur; iii) professional-oriented activities consisting of having shared goals, shared responsibilities, shared focus on student learning and shared focus on continuous teacher learning. The results of [61] support Meeuwen's previous findings that shared goals, leadership and structured activities contribute to teacher job satisfaction. Motivation is a key factor in the introduction of PLC activities. The lack of social support will hinder the exchange of teachers' experiences on these activities. Furthermore, how to integrate technology as a medium in virtual professional development training platforms? [62] study found that online programs in professional development training can be conducted with two focuses: flexibility, which emphasizes the complexity of asynchronous or synchronous spaces and physical or online meetings, and relevance, which emphasizes the connection between teachers' practices on subjects in their schools.

3.3.1 Components of Green Entrepreneurship Teacher Professional Development Training Program through VPLC

Based on previous studies, the conceptual model in the components of professional development training activities using a virtual PLC approach can be seen from several components in Table 2.

Table 2. Component Design of green entrepreneurship training through VPLC

Component	Description
Training Objectives/Core competencies	Master the concepts, attitudes and skills on green entrepreneurship. [55], [63], [64], [65], [66], [67], [68], [69] Design teaching with green entrepreneurship projects.[70], [71]
Resources and teaching materials	Online training modules that can be accessed through the e-learning platform used in the training. [19] Practical guides and case studies are required to be shared with training members. [2], [72], [73]
Teaching method	Digital teaching materials such as videos, presentations and research articles related to green entrepreneurship. [44], [74], [75] Teaching methods could include collaborative learning; discussion and reflection; case studies, problem-based or green entrepreneurship projects; mentoring or coaching for VPLC members who are more experienced in green entrepreneurship. [21], [76], [77]
Teaching media	Technology platforms such as Learning Management System (LMS) or Google classroom to provide content, asynchronous shared discussion forums, and other learning activities. [57], [61] Live joint discussion for interactive (synchronous) through video conferencing e.g. zoom, google meet, etc.[20] Workspace in working on green entrepreneurship projects together through cloud computing, for example, google drive, google doc, spreadsheet, and other platforms for collaboration between VPLC members. [23]
Duration	Minimum of 20 hours for up to one semester of the academic year (continuous) [2], [15]

Table 2 illustrates that the VPLC training activities aimed at teacher professional development in green entrepreneurship have several interrelated components. This component starts from the objectives of the training activities clearly presented, namely on mastering the concepts and skills of green entrepreneurship, which in the end teachers are expected to be able to develop effective learning designs in their classes. Several things are taken into consideration such as teaching methods in this training can be determined as needed based on teacher needs analysis [32], [36]. In addition to

facilitating teachers to collaborate both synchronously and asynchronously, it is important to provide case studies and projects that aim to develop green entrepreneurship learning in schools [28]. The preparation of media and technology is important because the focus of this training activity is virtual activities in a professional learning community.

3.3.2 Implementation Stages of Green Entrepreneurship Teacher Professional Development Training Program through VPLC

The implementation stages of the teacher professional development training program through VPLC are presented in Table 3.

Table 3. Implementation stages of green entrepreneurship training through VPLC

Stages	Activities
Planning and Preparation	<p>Teacher training needs were analyzed through surveys and topic prioritization. The plan of topics to be provided is discussed in Table 1. [59]</p> <p>Development of training modules and teaching materials [70], [78], [79]</p> <p>Providing technology infrastructure, a team of facilitators and socialization of activities to teachers [80], [81]</p> <p>Establishment of VPLC virtual learning community and delivery of activity objectives [62]</p>
Implementation	<p>Virtual learning sessions through workshops and seminars on green entrepreneurship and the topics in table 1 [80]</p> <p>Continuous learning through virtual discussion and collaboration [82]</p> <p>Green entrepreneurship case studies and projects [47], [83], [84]</p> <p>Continuous evaluation of VPLC members' progress through feedback and assessments provided by the facilitator [36]</p>
Evaluation, Reflection and Follow-up	<p>Individual and group reflection to plan a follow-up for improvement [85]</p> <p>Adjustments to the program are required from the evaluation results such as improving teaching methods, teaching modules, e-learning platforms, etc. [86]</p>

Table 3 is a recommendation of stages that can be done in facilitating teachers in virtual professional learning activities to explore green entrepreneurship. These stages certainly cannot be done randomly but sequentially in order to achieve the objectives of the activity effectively. The stages begin with planning and preparation such as needs analysis, provision of teaching materials and modules, provision of technology media, formation of a facilitator team and socialization of activities. This is important because it is this stage that will determine whether the next stage can run well. The second stage

is the implementation of the VPLC, starting with the delivery of the objectives of the training activities, exploration of green entrepreneurship with collaboration between VPLC members until they develop a green entrepreneurship project to be applied in the classroom and school. The role of active participation of participants and commitment to continuous learning in this community determines the success of the program. [54] research provides evidence that school leadership and other stakeholders can encourage effective training activities. [61] supports that shared goals, leadership and structured activities contribute to teacher job satisfaction. The ultimate goal of this training activity is certainly to contribute to teachers to improve their professionalism, especially in efforts to provide and practice green entrepreneurship in their classrooms and schools.

The role of establish green entrepreneurship in the long term supports sustainability (SDGs) [8]. Education has a role to be able to contribute there through habituation that can increase interest in green entrepreneurship, in the end they have green behavior at school. Thus, teachers are expected to be able to act through a small step to mobilize environmental and sustainability-oriented educational activities [12].

4 Conclusion

The purpose of this article is to develop a conceptual model framework in teacher professional development program training activities that provide green entrepreneurship practices using the virtual professional learning community method. Professional development program training has important characteristics including objectives, methods, resources and facilities, partners, duration of implementation and digital media to be used. These characteristics become the basis for planning, implementing and evaluating training activities. The green entrepreneurship training focused on several topics such as the basic concepts of green entrepreneurship, environmental and sustainability issues, green technology and innovation, pedagogy and teaching, environmental regulations accompanied by case studies, best practices and projects. Finally, the green entrepreneurship training design framework contains important components including the main objectives of the activity, facilities, teaching methods, media, and the duration needed for the activity to run effectively. The implementation of teacher professional development training in green entrepreneurship using virtual professional communities has stages, namely the preparation stage, consisting of needs analysis to the provision of technological infrastructure, the implementation stage consists of the formation of virtual professional communities, training sessions to the provision of green entrepreneurship projects, and the last stage is evaluation, emphasizing reflection and ending with follow-up for improvement. The implications of the research show that the conceptual framework of green entrepreneurship training can be used as a recommendation for education that wants to contribute to increasing environmental awareness and sustainability in school practices. The implementation of professional development program training requires the collaboration of partners such as universities, communities and governments to provide support so that sustainable development goals can be realized through education.

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