



# Education for Environmental Sustainability: Does the Vocational High School Industrial Internship Program Develop Students' Green Innovation Skills?

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**Abstract.** The attempt to improve the quality of human life can be instilled in the educational environment to realize environmental sustainability. This study aims to analyze the industrial internship program in developing Green Innovation skills of vocational students. The research method uses a qualitative descriptive study with data collection techniques through in-depth interviews, observation, and documentation. The unit of observation and unit of analysis consisted of students as internship practitioners, teachers accompanying internships, as well as employees and managers of private hotels as one of the industrial internship sites. The data analysis technique used Spradley's domain analysis. The results showed that the development of students' green innovation skills can be formed through an industrial internship program, even before the internship has been implemented circular economy habituation in learning and extracurricular practices. Green innovation skills of students from the technical side include: smart digital solutions, sustainable products and services designer, circular economy expert, green business management, process automation for waste management. While in terms of general skills, among others: Creative, initiative, communication, teamwork, entrepreneurial competence, open mindset, protecting the environment, problem solving, use of technology and machinery, mastery of competencies according to field of expertise.

The implication of this research is that synergy between students, teachers, industry and government is needed to work together in maintaining a healthy environment for the next generation in realizing the practice of environmental sustainability through education.

**Keywords:** Industrial Internship, Vocational Education, Green Innovation, Circular Economy, Environmental Sustainability, Sustainable Development Goals (SDGs)

## 1 Introduction

Climate change, environmental degradation and environmental sustainability are pressing global issues today [1]. Many countries such as in the European region [2], [3], Finland [4], Sub-Saharan Africa [5] have realized the importance of integrating the concept of sustainability in various sectors, including education. The United Nations through the pillars of the Sustainable Development Goals (SDGs) emphasizes concrete action in protecting the environment and the sustainability of nature for the next generation. In this context, green innovation is a key element to achieve economic growth and economic activity so as not to damage the environment, creating alternative environmentally friendly and sustainable solutions [4], [6].

Industrial transformation 4.0 requires 4.0 construction skills that aim to increase productivity [7] so that it is closely related to the digital ecosystem, Circular Economy, Smart cities, and the Internet of Things [8], [9]. The ability of graduates who master technology will have an impact on the learning experience so that the need for skilled professionals who are able to manage technology well [10] in the future in the future [11] can even compete nationally to globally [12]. This is a challenge for vocational education because it prepares them to enter the world of work which not only emphasizes skills [13], but has awareness in environmental sustainability [4].

Currently the main problem in vocational education in Vocational High School is the lack of integration of sustainability and green innovation concepts in the curriculum, as in France it was found that the textbooks used in schools for the last 30 years have not provided elements of sustainable development and the environment [14]. It is also the case in Malaysia that sustainability literacy in vocational schools still shows low awareness in students and the uncertainty of professional teachers developing knowledge about sustainability [15]. On the other hand, the limited facilities and data resources that educational institutions have in supporting sustainable education and eco-design is another issue [16]. Students become underdeveloped in practical experience in green innovation-oriented education, making it less effective. This will also limit their ability to innovate and develop green solutions in the workforce. Finally, limited access to support industry collaboration and participation with vocational schools is still experienced as a difficulty in Indonesia and Laos [17]. This makes graduates less prepared to face work demands, especially in the context of sustainability.

Some of the causes of problems in the understanding and practice of environmentally and sustainability-oriented vocational education can be identified as follows: First, the curriculum in vocational schools has not been adapted and oriented to environmental

and sustainability issues, which requires adaptation in the curriculum in schools [18]. Furthermore, teachers' lack of understanding of sustainable education issues underpins the lack of learning oriented towards green innovation solutions in schools as a result of the lack of training and the difficulty of incorporating the SDGs into teachers' courses [19]. In addition, the lack of campaigns on environmental issues and sustainability of natural resources results in low awareness in both teachers and students in the school environment [20]. The existence of a campaign on environmental conservation can increase 10% of awareness in individuals [21]. Another factor that causes limited facilities and resources in educational institutions in supporting sustainability programs is the lack of financial support so that this becomes an obstacle for schools to develop and learning about sustainability issues becomes less effective [22]. Another cause is the focus on allocating the school's resources to basic needs and school operations, while investing in sustainability facilities is considered less urgent. Lastly, the limited access to collaboration between Vocational High School and industry in industrial practice has weak coordination, especially in the focus of sustainability. Differences in interests in collaboration between schools and industries trigger ineffective achievement of educational goals [23]. This makes it difficult to achieve beneficial cooperation, especially in the orientation of sustainability programs between the two parties.

Given the urgency of environmental awareness and sustainability in schools, especially in Vocational High Schools, this research is important because green innovation provides many benefits. Encouraging green innovation in Vocational High Schools will reduce the skills gap of students which is useful for them in preparing to become a workforce in the industrial era 4.0 [4]. In addition, these skills can be provided early on because they are the generation who become agents in sustainable development [24]. Green innovation is also capable as an alternative solution for education to contribute to reducing environmental problems [25]. Students who have green innovation skills may be able to help develop appropriate solutions in their communities that love the environment and nature. In addition, awareness of the environment is high because it can provide understanding to practice to students in various learning opportunities at school. Finally, education that integrates green innovation directly contributes to the achievement of the SDGs [26], [27].

Vocational High School in its program provides industrial practice opportunities for students to get to know field work practices. Industrial internship is one of the school's efforts to synchronize the current industry needs so that students can participate directly in the field in real life [28]. The selection of industries that have a baseline on environmental orientation is a consideration for schools to support the achievement of sustainability [29]. These industrial internships play an important role in shaping students' skills [30], [31]. In addition, the practical experience that students do not get in the classroom, they gain firsthand in the utilization of technology and the production process [31].

Green innovation is an attempt to create a product innovation that can reduce the negative impact of business on the surrounding environment [32]. The practice of green innovation initiatives considers environmentally friendly innovation practices in product manufacturing, processes and natural resource management [33]; and refers to reducing the possibility of negative impacts of products that impact the environment, and

the desire to prevent potential waste generation during the product life cycle to address environmental issues [34]. Industry in practice seeks to minimize emissions and other environmental management techniques through beneficial stakeholder partnership cooperation.

According to Pattinson, industry players need to develop collaborations with other institutions to find environmentally friendly solutions that provide benefits to society and the environment as well as profit in overcoming the creation process [35]. The development of new environmentally friendly products and business processes or green innovation can increase market value, good corporate image and improve green innovation technology and social performance [36]. One of the important elements of environment-based industrial progress is to combine technological innovation with ecological protection, namely green innovation [37]. Green innovation should aim to generate significant environmental benefits rather than reduce environmental burdens [38], [39]. These green innovations may include products, services, processes, business models and/or marketing efforts [40], [41]. Therefore, green innovation involves various efforts to improve environmental sustainability as well as the achievement of sustainable processes [42] that ultimately achieve sustainable development goals (SDGs) [43], [44]. Green innovation for industries is important because it can reduce production waste while improving productivity, industry reputation and increasing their competitiveness [45].

Some previous research has been done to see green innovation skills can be formed in students by emphasizing sustainability in education. The factors driving green innovation include: self-ability, customer demand for products made by them, community expectations, product differentiation, resources, other environmentally friendly competitors and their personal values and ideas [45]. The skills required to drive green innovation were conducted in Findanlia [4] and found to include: 1) experts in green innovation, 2) Sustainable product designers, 3) Experts in green innovation and digital competence, 4) Designers with a green mindset, 5) Developers of advanced solutions, 6) Experts in calculating carbon footprints, 7) Experts in automating waste management processes, 8) Experts in monitoring sustainability principles, 9) Experts in Circular Economy Practices, 10) Sustainable forestry consultants, 11) Experts in cybersecurity, 12) Big data analysis in technology, 13) Project managers with expertise in waste management, 14) Practitioners in maintaining smart buildings, 15) Manufacturers with a green mindset and knowledge of green technology. Based on some of the skills or technical jobs needed to encourage green innovation, it can be concluded that this type of work is a factor that can produce green innovation.

The previous research has provided evidence that green innovation skills are important to be given to vocational students. However, the difference with previous research is that there has been no emphasis on green innovation through industrial internship programs. Based on the researcher's initial observations and interviews, it was found that: 1) several fields of expertise of Vocational High School schools in Salatiga City have a habit of managing waste from school practices such as fashion waste, office management and business services managing paper waste, and catering and culinary managing cooking oil waste. 2) Students' self-habitation in loving the environment at

school through a routine program of cleaning the school environment and extracurricular environmental activities, 3) school appeals to reduce the use of plastics, 4) school and industry cooperation as an effort to link and match current industry needs. Some of these phenomena are interesting to study because the school indirectly pays attention to the environment in every learning process in the classroom and outside the classroom. Therefore, the purpose of this study is to see how green innovation skills can be formed in vocational students through industrial internships as a form of collaboration between schools and industries.

## 2 Method

The research was conducted using qualitative methods by exploring the phenomenon of green innovation skills through data collection techniques such as semi-structured interviews (face-to-face and online), available reports and databases [4]. This is intended to analyze vocational education activities that collaborate with industries that develop green innovation skills through intracurricular learning and field work practices. Collaboration with industry is important for schools to face changes in the labor market in the industrial revolution 4.0. Field Work Practices as a program of industry and school collaboration and other activities that support this collaboration.

The research was conducted at the State Vocational High School 1 Salatiga. The school was selected based on the interesting phenomenon of joint collaboration between industry and school that supports environmentally-oriented practices. One of the collaboration activities is through guest teachers and field work practices with entrepreneurs in Salatiga and Semarang Regency. In each activity, students are encouraged to incorporate creativity and innovation in planning and implementing their knowledge and skills to support a sustainable environment.

### 2.1 Materials

The data collection techniques in this research are through interviews, observations and documentation from Intracurricular Learning activities and Field Work Practices of one of the Vocational High Schools in Salatiga City. The in-depth interview technique was carried out by researchers in the interview process, namely by obtaining in-depth information and developing questions that have been made in the interview guidelines. Observation activities were carried out by visiting the implementation of intracurricular activities and the place of realization of school and industry collaboration. While documentation through supporting documents for the implementation of school collaboration and the industrial world. Data validation uses source triangulation by comparing observation results with interviews (teachers, students and industry parties both human resource managers and employees who have Field Work Practice cooperation agreements) and documents obtained with interviews.

Researchers used informant selection techniques through snowball sampling, namely asking for recommendations for further informants from informants who had been interviewed until the acquisition of data was saturated. Some informants who are

considered to understand the central phenomenon consist of students, teachers and several parties who are considered to know the phenomenon under study. The data to be obtained relates to industry and school collaboration oriented towards students' green innovation practices which in turn students will acquire skills that can be adapted to current labor needs.

**2.2 Data Analysis**

The data analysis used in this study used Spradley's domain analysis. After the data is obtained, researchers categorize it into domains and subdomains and look for semantic relationships. The stages of Spradley's domain analysis (2016) consist of: a) looking for semantic relationships, b) making a list of domain analysis worksheets, c) sorting out data that has similarities, d) looking for data that is included and covered, e) compiling structural questions, f) making a list of domains that have been found.

**3 Result and Analysis**

This research focuses on analyzing the collaboration between industry and vocational education schools in preparing students' skills oriented towards green innovation. The school has 6 skill programs consisting of Institutional Accounting and Finance, Office Management and Business Services, Marketing, Spa and Beauty, Fashion and Culinary. Interviews, observations and documentation have been conducted during the research process at school and at industrial sites. During the fieldwork, students were observed during fieldwork practice and activities at school. Documentation of environmentally friendly oriented activities is supported by documentary evidence owned by teachers, students, and industry staff employees. The internship site chosen was a hotel that prioritizes environmental sustainability in Salatiga city based on the school's recommendation.

In this section, the findings are presented and organized according to the thematic framework. Table 1 shows a summary of the main categories identified under each theme. A detailed explanation of these findings follows.

**Table 1.** Summary of key themes and categories

Themes	Categories	Sub-Categories
Implementation of Green Innovation in Schools	Habituation of school green innovation Students' skill development	Intracurricular and Extracurricular Education and training; Industry-school synchronization; Internship provision; Expo forum; Competency certification

Implementation of Green Innovation in Industrial Internship	School collaboration with industry through internships	Planning; Implementation; Evaluation  Technical Skills: Smart digital solution, Sustainable products and services designer, Circular economy expert, green business management, Process automation for waste management
Output of Collaboration between Vocational High School and Industry	Formation of students' Green Innovation Skills	General Skills: Creative, initiative, communication, teamwork, entrepreneurial competence, open mindset, environmental protection, problem solving, use of technology and machinery, mastery of competencies in the field of expertise.

Based on the data in Table 1, the summary of research findings is given through themes, categories and sub-categories. The following is an explanation of each Theme, Category and Sub-Category based on the research domain analysis.

### 3.1 Domain 1 Analysis of Green innovation Students in Vocational High Schools

The implementation of green innovation at Vocational High School in Salatiga is presented through domain 1 analysis which has semantic relationships between domains and sub domains. The following is a domain 1 analysis based on data collection in the field, namely:

**Table 2.** Domain 1 Analysis of Students' Implementation of Green Innovation in Vocational High Schools

Sub Domain Details	Semantic Relationship	Domain	Interview Code
Intracurricular, Extracurricular Education and Training	are the scopes of	Habituation of school green innovation	SA-22, IS-14, L-27 L-28, SAA-10 SAA-4, SM-22, IS 15
Industry-school synchronization Internship debriefing Expo Forum	are the forms of	Students' skill development	L35, SM 7-8, 28 1-17 RA-7 L-23 SM 6, RA-7

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Competency Certification

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Based on the data in table 2, it shows that domain 1 analysis has a domain in the habituation of green innovation in the Vocational High School school environment. The habituation of green innovation in schools is provided through learning ranging from intracourse, co-curricular, and extracurricular. On the other hand, schools provide facilities in developing green innovation-based vocational education through several activities including education and training, industry-school synchronization, internship debriefing, work expo forums, and certification of student expertise competencies. The purpose of this green innovation is to be able to increase market value, good image of the school, improve environmentally friendly innovation technology [36]. In addition, this initiative can reduce production waste while increasing productivity [43].

**3.2 Domain 2 Analysis of Students' Implementation of Green Innovation in Industry as an Internship Site**

The following is an analysis of domain 2 as a result of finding semantic relationships between domains and sub-domains in the application of green innovation in one of the industries where vocational students intern. The pattern of semantic relationships can be displayed in table 2 as aspects that cooperation partners work on with other institutions.

**Table 3.** Domain 2 Analysis of School Collaboration with Industry as Internship Site

Sub Domain Details	Semantic Relationship	Rela- Domain	Interview Code
Planning	are the implementation of	School collaboration with industry for internships	RA-7, 11, SM11
Practice			SM-11, RA-10, SM-18
Evaluation			RA-17, RA-20

Based on table 3, the analysis of domain 2 shows that school-industry collaboration at one of the hotels in Salatiga appears since the planning of cooperation, practice at the hotel and evaluation as a supervision of student performance. The work culture of these three aspects is considered by the hotel to achieve the objectives of student internships in the workplace according to the targets of the school. On the other hand, the school does not prohibit the industry to be able to provide more experience to students than the expected target.



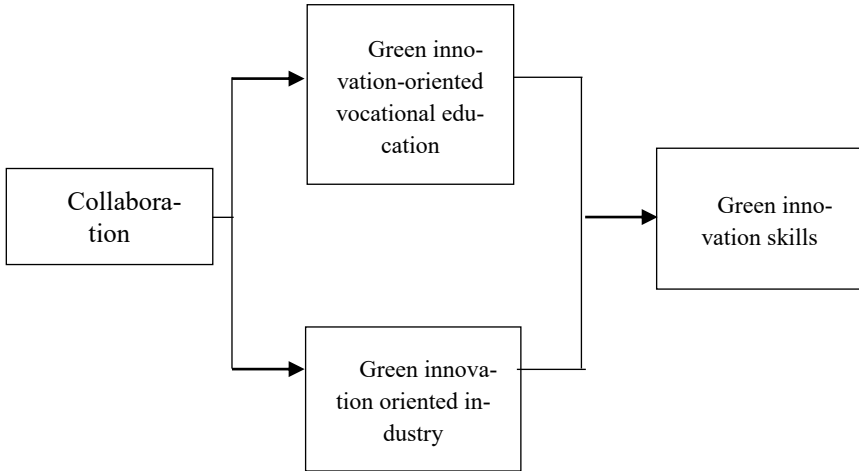
### 3.3 Analysis of Domain 3 Output Collaboration between School and Industry through Internship

**Table 4.** Analysis of Domain 3 Output Collaboration between School and Industry through Internship.

Sub Domain Details	Semantic Relationship	Domain	Interview Code
1. Technical Skills: Smart digital solution, Sustainable products and services designer, Circular economy expert, green business management, Process automation for waste management	Are the output forms of	School collaboration with Green Innovation-oriented industries	IR-7, SAA-27, IS-7, L-14, SAA-22, SM-6, SAA-28, SA-10, RA-5, IS-19, L-23, SM-9, L-25, SAA-34, SAA-23, RA-9, IS-15, SAA-16, SM-10, IS-10
2. General Skills: Creative, initiative, communication, teamwork, entrepreneurial competence, open mindset, environmental protection, problem solving, use of technology and machinery, mastery of competencies in the field of expertise.			

Based on table 4, domain 3 analysis shows that school collaboration with hotels oriented towards green innovation provides output in the form of student skills. These skills are divided into 2 aspects, namely technical skills consisting of Smart digital solutions, Sustainable products and services designer, Circular economy expert, green business management, Process automation for waste management. While general skills consist of Creative, Initiative, communication, teamwork, entrepreneurial competence, open mindset, protecting the environment, problem solving, use of technology and machinery, mastery of competencies according to field of expertise.

Based on the results of the analysis of domain 1, domain 2, and domain 3, the domain analysis work pattern can be stated in Figure 1. Figure 1 shows that the skills of Vocational High School Salatiga students oriented towards green innovation can be obtained from the collaboration of vocational education practices and industries that prioritize green innovation practices. The following is a working pattern of domain analysis of the results of collaboration between vocational education and industry for student skills. Figure 1 shows the collaboration between the two parties, namely schools and industries that work together in equipping students before entering the world of work according to current industry needs. Internship practices are carried out by applying the principle of green innovation with the ultimate goal of forming increased skills without damaging the environment as a result of the business activities carried out



**Figure 1.** Working pattern of domain analysis of the results of collaboration between vocational education and industry in improving students' skills oriented towards green innovation.

### 3.4 Data Description and Analysis

The description of the research data is obtained from the exposure that has been described in the work analysis of domain 1, domain 2 and domain 3, among others: 1) Habituation of Green Innovation at school, 2) Development of green innovation-based vocational education, 3) Application of Green Innovation in industrial apprenticeships, and 4) Results of school collaboration with Green Innovation-oriented industries.

#### 3.4.1. Habituation of green innovation at school

##### 3.4.1.1 Intracurricular learning activities.

Vocational high schools in Salatiga City have a culture of environmental stewardship in various school activities. The school has several expertise programs that have their own characteristics in preparing students to enter the workforce in the future. Intracurricular learning is provided through general and vocational subjects. Students are given an understanding of the norms of life as living beings who are able to love the environment and other humans. One of the subjects chosen is the natural and social science project. Learning is provided through providing contextual experiences about life themes. This is supported by the teacher interview statement: “...in the flow of learning objectives mentioned related to nature, living things and the environment ...” (IS-1). Another interesting thing in vocational schools related to this subject is that each

expertise program adjusts itself according to their needs: “...*each department is different, beauty skills ask for orientation to the human body, while other skills for environmental management through utilizing unused goods recycled again...*” (IR-1).

On the other hand, subjects are also oriented towards waste management in each vocational area. Office management and business services and accounting skills produce paper waste and they can utilize the paper into paper artwork such as a map, crafts, to reduce the use of paper oriented to office applications. Beauty skills utilize towel waste into flower pots, cable waste into makeup accessories. Culinary skills have also led to collecting leftover cooking oil from food production practices. Fashion skills utilize patchwork, leftover yarn into a work that can be valuable and even resold. Of course, the learning orientation of vocational students has favored green innovation-oriented practices. Some students have also realized the importance of using energy and natural resources wisely during their production practices in the classroom and laboratory.

#### **3.4.1.2 Extracurricular learning activities.**

The practice of green innovation is also felt by some students who have an interest in caring for the environment through the communication of environmentalists. Some activities are carried out together to protect the surrounding environment from the adverse effects of activities at school. Students stated; “... *green house and pond cleaning program, making hydroponics, planting green plants in the school environment, participating in finding garbage in the framework of world clean-up day 2023, participating in composting training and many more...*” (SAA-4). In addition to extracurricular activities, the school has implemented green innovation as a school culture to love the environment such as activities every week cleaning the environment together and doing sports activities. The participation of all school members as a form of implementing green innovation from the other side.

#### **3.4.2. Development of activities in vocational education in shaping skills**

##### **3.4.2.1 Education and Training.**

The attempts to achieve the goals of vocational education to prepare students to be able to adjust the development of science and technology are pursued in various efforts. Some of the supporting activities facilitated by the school to provide superior interests and abilities include education and training. The school holds guest teachers as a form of collaboration with other institutions or practitioners to provide insight and good practices according to the expertise program at school. The teacher explained that: “guest teachers are given twice a year for each class for material that teachers feel they have not mastered in terms of tools, skills, we look for practitioners” (SM-7).

##### **3.4.2.2 Synchronization of industry and school.**

The school collaborates with the industry to synchronize current needs which are eventually included in the learning curriculum. The teacher stated that: “...there must

be synchronization of school learning with industry, determining the material obtained according to the development of competencies that they must master..." (L-17). Schools synchronize the curriculum with changes and developments in the skills program, giving students the opportunity to register for certain soft skill programs and register for hard skill programs [46].

### **3.4.2.3 Competency Certification.**

In addition, means that can provide developmental adjustments in realizing green innovation-oriented industrial collaboration through guest teachers, internship debriefing, waste utilization work bazaars, and student competency certification. The industry even supports certification registration for students as apprentices. This was echoed by a manager, "we inform the registration of competency certification to schools through us, we register it because it is very supportive..." (RA-7). Support for the formation of students' skills can be felt from industries that have collaborated with schools and even provide benefits.

## **3.4.3. School collaboration with industry for internship practice**

### **3.4.3.1 Internship Planning.**

The industry in this study was conducted at a hotel in Salatiga. The hotel's management begins with a partnership plan with the school. The Merdeka curriculum in Indonesia encourages vocational schools to collaborate with industry to provide experience in the field through internships. This cooperation makes schools and industries enter into agreements to provide internship briefings to students before practicing at the hotel. This is supported by the teacher's statement: "The briefing before the internship brings in the industry to introduce the work culture, explain the internship and its rules and motivate them..." (SM-11). This was confirmed by the hotel manager: "...we give an overview of the company profile, the benefits of internship practice in the hotel anyone..." (RA-7).

### **3.4.3.2 Implementation of Industrial Internship.**

Industrial internships as a result of cooperation between schools and hotels are given for one semester, which is 6 months. Students are placed in departments according to their respective expertise, for example office management and business services are placed in the front office or human resource manager's office. Culinary skills are placed in the kitchen, bakery or restaurant department. The teacher explained, "... the LA hotel manager, Mrs. RA, accepts internship students to be placed in the front office, accounting in the finance department..." (SM-11).

The internship practice at this hotel provides a lot of experience to actively contribute to protecting the environment. The company applies recycle and cultivates natural resources around the hotel environment. Some things that show the hotel has implemented green innovation include the re-creation of handicraft creations around the hotel

from wood waste, leaves, and promoting the local potential of Salatiga through nature. Reduction of plastic bottles in the hotel environment and replacing them with refills of drinking water provided around the hotel, campaigns for efficient use of electricity, water and gas energy and the use of paper switching to digitalization. This proves that the company supports green innovation. They encourage student interns to be able to carry out the principles and work culture there.

#### **3.4.3.3 Industrial Internship Evaluation.**

The company briefs students to carry out internship tasks with green innovation experience. Their abilities are evaluated and monitored by the leadership regarding the work targets that must be completed. Daily reports are the goal for students to be practiced with enthusiasm and enthusiasm. Students report which work has and has not been completed. This is evidenced by the manager's statement: "I give the task of reporting daily work so as not to forget and can be done correctly" (RA-11).

#### **3.4.4. The Role of Schools and Industries in Embedding Green Innovation to Shape Vocational Education Students' Skills**

It has been discussed previously that the practice of green innovation in the school environment and in industrial internships provides new experiences for students. The following presents the results of joint collaboration between the two parties for student skill development.

##### **3.4.4.1 Green Innovation Technical Skills.**

Based on the results of the data analysis that has been carried out, it is found that schools familiarize students to be directly involved in protecting the environment and minimizing impacts as a result of production practices at school. Researchers grouped the technical skills that lead to the practice of green innovation into 5, namely: 1) Smart digital solution, Students have been equipped with digitalization of menu barcodes in culinary practices as a solution to the use of paper and plastic in menu books because the menu is provided digitally. Students practice the use of applications in processing information administratively so that in this case it can minimize the use of paper. These practices are a form of smart digital solution. 2) Sustainable products and services designer, students apply sustainable products and services designer as seen from the orientation of students during practice to favor products made from natural ingredients, natural dyes in clothing, minimize paper in reporting, utilize culinary production waste, and participate in maintaining the balance of energy use at the internship site. 3) Circular economy expert, Production practices in each field of expertise at school make students skilled in recycling waste remnants from production units such as patchwork, cables, towels, paper, cardboard, and others into valuable goods. This is supported by the teacher's statement, "You can make it into interesting things later it will give more value" (IS-2). 4) Green business management, the school's work culture promotes minimizing the use of energy such as electricity during practice, reducing plastic materials,

storing leftover culinary skills practices such as cooking oil waste. and 5) Process automation for waste management. The office management and business services expertise program prioritizes the use of office automation, applications that facilitate work, minimize the use of paper turning to digital documents. The concern of all school elements for the environment can foster an environmentally friendly oriented work ethic will be created [4]. It provides evidence that secondary vocational education (Vocational High School) has better labor market opportunities because they can enter directly into the labor market that generates employment status and wages through their skills [47].

#### **3.4.4.2 General Skills for Green Innovation.**

General skills for the students are formed both in soft skills and hard skills. Grade 10 students are equipped with a basic understanding of their respective fields of expertise to find passion for their majors, which in the end the learning is related to the environment. The next level, grade 11 students are given an understanding accompanied by the practice of their expertise and begin to utilize the remaining waste from their production. grade 12 first semester, students begin to intensively practice and practice their expertise. second semester, they practice internships in industries according to their choice of interests. Teachers provide a module containing a flow of learning objectives to be implemented during the internship. Allocating soft skills proportionally in the curriculum and learning process can shape Vocational High School graduates to have a greater chance of getting jobs and careers in the era of the Industrial Revolution 4.0 [48]. Students in vocational schools are taught different skills depending on the needs of the labor market. The business world and industry really need qualified and productive graduates [49], [50]. Soft skills and hard skills competencies are the main determinants of employment opportunities for Vocational High School graduates in the era of the Industrial Revolution 4.0 [48], [51], [52]. The industry that provides work certainly has competency qualifications and character from Vocational High School graduates with their expertise background.

Some general skills found that students' skills as a result of implementing green innovation in school and industry include: 1) Creativity, students are skilled in processing their remaining production waste, applying digital solutions as a business service practice and utilizing unused items for works that can be displayed at the work show. 2) Initiative, in this skill, apprentices strive for initiative in industrial practice. They also encourage other students to protect the environment, campaign to reduce plastic waste, start to protect the environment both in school and industry. 3) Communication, this was found both during school in completing projects, discussions and reporting. In addition, industrial internships also students learn to convey their ideas and dare to speak to others. 4) Teamwork, this skill is also formed during students working on group-based projects. Students also work together with the entire hotel to work efficiently. 5) Collaboration, students collaborate with other students, teachers, environmental agencies, communities, industries to campaign to protect the environment. 6) Entrepreneurial competence, students are taught to be oriented towards the skills of compiling business proposals, implementing and reporting them. Students are directed to be able to

give more value to an item to be sold with digital marketing. 7) An open and developing mindset, students in the process of practicing green innovation initiatives can be directed and some even begin to increase their level of confidence in producing work. 8) Protecting the environment, students have initiatives in caring for the environment from various aspects, their actions as a form of protecting the environment in a sustainable manner. 9) Problem solving, students have a way to be able to overcome the problem of waste after knowing the impact produced. Some of their work designs are a form of efforts to overcome environmental problems such as waste from practice, minimizing excessive energy use, to orientation towards entrepreneurial practices. 10) The use of tools, machines, and internet technology as a form of digitalization. Students can use several facilities available in schools and industries to support green innovation practices. Student performance becomes faster, easier and reduces environmental impact. 11) Mastery of the field of expertise increases. Students after industrial practice certainly find new experiences compared to before. The use of equipment and technology as well as energy saving campaigns are prioritized principles. The principle of skill development by favoring green innovation can establish partnerships between industry and vocational education, so that vocational student graduates can play a major role in reducing unemployment [53].

## 4 Conclusion

Based on the results of the analysis that has been presented, it can be concluded that collaboration between the apprenticeship industry and schools can shape the skills of vocational students oriented towards green innovation. The role of this collaboration provides opportunities for vocational students to develop skills based on their respective fields of expertise to be able to show a person who favors the environment. Schools play a role in providing direction through learning both intracurricular and extracurricular. On the other hand, development in activity facilities is carried out through education and training, guest teachers, curriculum synchronization between schools and industry to answer the challenges of the world of work, and competency certification in shaping the professionalism of vocational student graduates. The form of collaboration is carried out in a cooperation agreement between the two parties, then the industry provides industrial internship briefings, the implementation of industrial internships to evaluate internship activities. These activities shape students' skills both from a technical aspect leading to green innovation such as smart digital solutions, sustainable products and services designers, circular economy experts, green business management and process automation for waste management. Other skills are formed in terms of hard skills and soft skills including creativity, initiative to take care of the environment, teamwork in managing waste and the environment, collaboration, entrepreneurial competence, an open and developing mindset, protecting the environment, problem solving, mastery of tools, technology and the internet and mastery of the field of expertise increases. Thus, the practice of green innovation in the scope of vocational education is new and important to equip students to have skills that prioritize sustainability. In addition to students, teachers, the industry is important to involve other institutions to the

government to work together in realizing a healthy environment for the benefit of the next generation in achieving sustainable development goals. The next implication is that vocational schools can develop a curriculum with an orientation towards sustainability and the environment so that green innovation in schools can be realized to support sustainable development. This research has limitations in qualitative analysis, future researchers can further develop green innovation skills through quantitative methods on sustainability and other variables.

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