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Evaluating the Effectiveness of the Teaching Factory Learning Model in Leading Vocational Schools: A Case Study of Agribusiness, Food Crops, and Horticulture Programs

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ABSTRACT

Teaching Factory (Tefa) represents a transformative paradigm in vocational education, designed to immerse students in real-world industry settings within the school premises. By integrating practical training directly into the curriculum, Tefa ensures that students gain hands-on experience alongside theoretical knowledge, fostering a comprehensive skill set. This innovative approach not only enhances students' employability but also cultivates a deeper understanding of industry practices, ultimately equipping them with the competencies needed to thrive in their chosen fields. This research reviews the evaluation of the implementation of Tefa learning at leading vocational schools in the Food Crops and Horticulture Agribusiness Study Program. The research method used was evaluation, using interviews, observation, documentation, and questionnaire studies. Based on the results of evaluation research on the implementation of the teaching factory learning model in the food crop and horticulture agribusiness skills program at SMKN A and B, the following can be drawn: Evaluation of the context, input, process, and product components shows promising results with percentages of 85.4%, 83.7%, 86.3%, and 83.4%, respectively. The data showed the effectiveness of practical learning in achieving vocational education goals.

Introduction

Teaching Factory (Tefa) is a learning model in vocational education that emphasizes direct training and experiential learning (Maksum & Ampera, 2024; Yoto et al., 2024). Tefa is designed to bridge the gap between academic learning and practical skills development by providing students with real-world experience in a simulated industrial environment (Suswanto & Adhikari, 2024). The Tefa model is based on the factory or industrial concept, where students learn by making products/services (Romadin et al., 2022; Siegert et al., 2020; Wijanarka, 2023). In Tefa, students work in teams to solve problems in industry according to their chosen field of study or expertise. Experienced instructors and mentors guide students and provide feedback and support throughout the learning process (Wahjusaputri et al., 2020).

Teaching Factory (Tefa) has significantly impacted the learning objectives applied to students (Ananta et al., 2023; Orozco et al., 2024). Through its practical learning approach, Tefa can provide valuable direct experience to students in facing the challenges of the industrial world (Dwijayanthi & Rijanto, 2022; Giffin et al., 2018). By being actively involved in projects relevant to the student's field of study, students not only deepen their theoretical understanding but also develop practical skills that are much needed in the workforce (Direktorat PSMK, 2015; Rejeki & Kuat, 2023). In addition, team collaboration in learning activities allows students to expand their professional networks and improve their interpersonal skills (Romadin, 2023; Susila et al., 2021). Thus, the Teaching Factory is not just a place of learning but also a vehicle for preparing students to become professionals ready to enter the industrial world with confidence and competence.

Agribusiness of Food Crops and Horticulture (ATPH) is one of the disciplines at Vocational Schools that explores the concept of agribusiness in the context of food crops and horticulture (Ardana, 2021; Kemendikbud, 2019). ATPH refers to economic activities related to the agricultural sector or other fields in the production and marketing stages. Agribusiness is an economic perspective on efforts to provide food. In this way, ATHP vocational schools study strategies to gain profits by managing various aspects, from cultivation, raw material supplies, and post-harvest processes to marketing.

The development of agribusiness and agriculture in Indonesia is considered very advanced and rapid. This is proven by official data from the Indonesian Ministry of Agriculture obtained from the Ministry of Trade, which shows that coffee exports from Indonesian coffee farmers reached 138.8 tons in 2017 and 123.6 tons in 2018 (Hendriawan, 2024). It is important to note that Indonesian coffee production has succeeded in penetrating the United States market, with an export value reaching 138.6 tons in 2017 and 123.6 tons in 2018 (Judijanto et al., 2024; Salsabila et al., 2024)

In connection with the rapid sales in the agricultural industry, the world of education must keep pace to boost superior products. The teaching factory in the Department of Agribusiness, Food Crops, and Horticulture at SMKN 1 Mlarak Ponorogo, East Java Province, and SMKN 4 Gowa, South Sulawesi Province, is a school that has prepared graduates to be able to promote superior products. To maintain the quality of learning, a program must be continuously evaluated. Evaluation is a process that measures the achievement of objectives by providing information for better decision-making; this helps ensure the effectiveness and relevance of a program or activity (Oktafiani et al., 2022; Pratiwi, 2019; Qolik et al., 2021; Savira et al., 2020). The CIPP evaluation model, which includes context, input, process, and product, has proven effective in providing a comprehensive framework for evaluating various aspects of a program or activity. Through this approach, evaluation can be carried out comprehensively, from identifying the context and input to monitoring the process and results achieved (Allouche et al., 2014; Hakan & Seval, 2011; Supriyantoko et al., 2020; Susilawati et al., 2016)

Thus, this article reviews the evaluation of the implementation of the teaching factory learning model in superior vocational schools in the food crop and horticulture agribusiness study program, which focuses on context, input, process, and product. This evaluation aims to improve learning models in preparation, implementation, and evaluation and as a reference centre for schools that still need to implement teaching factories. This evaluation aims to provide a review of the products that the Vocational School has produced to increase public confidence that the Vocational School can compete in the agricultural management industry market.

Method

The research data collection method used the CIPP evaluation method, combining qualitative and quantitative data results. Data was collected using interviews, observation, documentation, and questionnaire studies. Research data was taken from 2 sites at SMKN 1 Mlarak Ponorogo, East Java Province (SMK A) in collaboration with PT. Organic Learning Center | (Indonesia Organic Center) and SMKN 4 Gowa, South Sulawesi Province (SMK B), which organizes teaching factories independently. These two schools are superior in the Agribusiness, Food Crops, and Horticulture Study Program, which has implemented a teaching factory learning model. The conceptual framework for conducting research can be explained in Figure 1.

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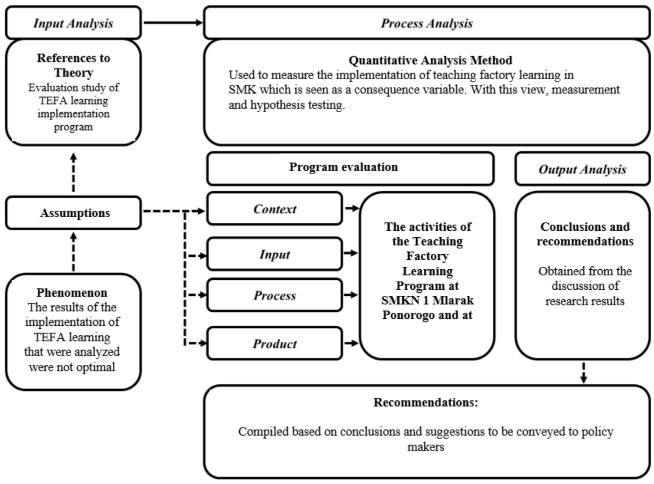

Fig 1: Conceptual Framework for Implementing Learning Model Evaluation Teaching Factory

Research data was collected using an evaluation method with several collection methods, namely:

1. Observation

Observations are used to collect data about human resources (teachers and those implementing the teaching factory), supporting facilities (buildings and rooms), and the implementation of the teaching factory program that shown on table 1.

Table 1. Observation Guidelines Grid

nt Aspect	Indicator	Data Source
Facilities and Infrastructure	Workshop/Laboratory	Workshop or Laboratory
Implementation of Learning	Conformity with RPP, Job sheet, and Block Schedule. Practice Materials Practice Base Implementation of Training Entrepreneurship	Teacher and student
Teacher's Role	The Role of Teachers in Context Education The Role of Teachers in Production Contexts	Teacher
Student's Roles	The Role of Students in Context Education The Role of Students in Context Education	Student
TEFA Learning Outcomes Products	Product Quality Consumer Satisfaction Follow-up on Sales Results Product Kepuasan Konsumen Tindak Lanjut Hasil Penjualan Produk	Workshop or Laboratory

2. Interviews

Interviews were conducted to dig deeper into the information. Interviews were conducted to gather information from the head of the teaching factory, teachers, and students involved in implementing the teaching factory that shown on table 2.

Table 2 Interview Guide Grid

Component	Aspect	Indicator	Data Source
Context	Learning process	Forms of Teaching and Learning Process that Involve Students in Teaching Factory Competency Improvement Student Increasing Entrepreneurial Spirit	Teacher
Input	Resource	Human Resources Facilities and Infrastructure Financing	TEFA Coordinator, Deputy Head of Facilities and Infrastructure
Procces	Cooperation	Partner Marketing	TEFA Coordinator
Product	Product	Qualitay Market Response Inovation Respon Pasar Inovasi	Teacher

3. Documentation

Documentation is carried out to collect data about the organizational structure of the teaching factory, a list of facilities and infrastructure, written job descriptions, products produced, and archived data on students involved in the teaching factory. The sources in the documentation are teachers involved in implementing the teaching factory that shown on table 3.

Table 3. Documentation Guidelines Grid

Component	Aspect	Indicator	Data Source
Input	Facilities and Infrastructur e	Facilities and Infrastructure	Vice Principal Facilities and infrastructure
Process	Teacher	RPP (Lesson Plan), Job Sheet, Workload, Schedule and Certificates	Teacher
	Management	*Job Desk, Schedule, MoU, Financial Administration, Teaching Material Administration, Monitoring Instruments, Curriculum, Policies*	Vice Principal Curriculum and Teacher
Product	Teacher and student	Products resulting from TEFA learning	eacher and student

1. Questionnaire or Quiz

The questionnaire used in this research is closed in nature, where in providing answers, the respondent only marks (√) in the answer column according to the conditions faced by the respondent and only takes a short time to answer. The data collection technique in this research uses a Likert scale whose answer scores can be seen in Table 4.

Table 4. Likert Scale

Answer Criteria	Score
Strongly agree	5
Agree	4
Somewhat agree	3
Disagree	2
Strongly Disagree	1

Questionnaire data is quantitative data that will be analyzed descriptively as a percentage, according to (Sugiyono, 2012) the analysis steps are adding up the total score for each component to calculate the percentage in table 5 using the following formula:

Information :

DP = Descriptive Percentage
n = Assess Each Component
n max = Maximum Value of Each Component

$$DP = \frac{n}{n\ max} \times 100$$

Table 5. Descriptive Data Analysis Criteria Percentage

Percentage	Category
91-100 %	Very Good
80-90 %	Good
51% -79 %	Good Enough
26% -50%	Not Good Enough
<=25%	Not Good

Data collection using a questionnaire was used to obtain primary data. This questionnaire is in the form of written questions shown to respondents, which helps collect information from respondents. Questionnaires or questionnaires are used to obtain data and information related to the teaching factory learning model for the food crop and horticulture agribusiness skills program at SMK A and SMK B.

The questionnaire/evaluation questionnaire instrument grid for the teaching factory for school principal respondents, deputy head of curriculum, teachers managing the teaching factory, and students can be seen in Table 6.

Table 6. Teaching Factory Evaluation Questionnaire/Questionnaire Grid

Component	Indicator	Data Source	SMK A Respondent	SMK B Respondent
Context	Formal Foundations of Teaching Factory Principal Policy	Principal, Vice Principal of Curriculum, Person in Charge of TEFA, Teacher	15	14
Input	Activity Planning Student Readiness Financing Teacher Readiness Facilities and Infrastructure	Vice Principal of Curriculum, Person in Charge of TEFA, Teacher	14	13
Procces	Learning Scheduling Teacher Performance Teacher Activities Student Activities	Vice Principal of Curriculum, Person in Charge of TEFA, Teacher	14	13
Product	Learning Outcomes	Student	36	42

Result and Discussion

The results of the evaluation research on the implementation of the Teaching Factory learning model in superior vocational schools in the food crop and horticulture agribusiness study program are described in 4 evaluation components, including:

1. Context Component

Evaluation of the implementation of the teaching factory in vocational schools, as seen from the context component, consists of two aspects, namely: (1) the formal basis of the teaching factory and (2) the principal's policy. These two aspects received a good category with an overall value for the context component of 47 out of an ideal score of 55 and a percentage of 85.4%. Results of the evaluation questionnaire assessment on the context component in the implementation of teaching factory learning in vocational schools.

Based on Table 7, the formal essential aspect of the teaching factory received a score of 23 out of a total ideal score of 25 with a percentage of 92%. Evaluation of the formal teaching factory basis is carried out to find out whether the school has implemented a teaching factory program that refers to the formal basis that has been established. Based on this evaluation's results, factory learning in vocational schools in the formal foundation aspect received a good assessment.

Table 7. Evaluation Results on the Context Component

Component	Aspect	N Average	N Max	%	Category
Context	Formal Foundations of Teaching Factory	23	25	92	Very Good
	Principal Policy	24	30	80	Good
	Total Score	**47**	**55**	**85,4**	**Good**

Evaluation of the principal's policy is carried out to assess teachers' ability to apply all the competencies and learner skills required in the learning process, mentoring or carrying out additional tasks relevant to school functions. The principal's policy on the Teaching fatory program in schools A and B is continually reinforced, and this is conveyed in fragments of time during school activity meetings. It can be seen that the principal has a deep understanding of the importance of Teaching Factory in improving the competence of vocational students. The policies implemented focus on industrial cooperation, curriculum adjustment, and provision of facilities. Challenges such as limited funding and lack of resources are overcome through creative efforts, such as collaboration with industry. Positive responses from students also indicate that the Teaching Factory successfully provides relevant experience and helps their work readiness. Further development plans reflect the school's commitment to continue developing the quality of this industry-based learning.

Based on the data processing results in this research, it can be seen that the questionnaire evaluation of the school principal's policy aspects received a score of 24 out of a total ideal score of 30 with a percentage of 80%. Based on the results of this evaluation, implementing factory learning in vocational schools in the principal's policy aspect received a good assessment category. This proves that school principals are pioneers and leaders in school-based management (Isnantyo et al., 2024).

Another formal basis that schools have implemented is supporting the alignment of process standards for primary and secondary education units, which states that teachers can use learning methods to create an appropriate learning atmosphere for students (Fattah et al., 2021; Harlianingtyas et al., 2024). Teachers can choose the proper learning method and adapt it to the conditions and situations of the students being taught so that the teacher can achieve each indicator and competency of the learning subjects being taught (Direktorat PSMK, 2015; Kemendikbud, 2019; Kemeny & Beregi, 2023)

The policy vocational school principals have taken is collaborating with the business and industrial world based on a mutually agreed memorandum of understanding (MoU). According to (Hadam et al., 2017; Slamet et al., 2017; Yoto & Widiyanti, 2017), implementing good and mutually beneficial vocational school collaboration with the business/industry world is very important to support the achievement of school programs. School development will be more optimal if cooperation with agencies related to the Business/Industrial World is relevant to the expertise competency stated in the MoU/understanding/collaboration agreement text. The MoU that has been agreed upon is then evaluated within a certain period to determine the effectiveness of implementing the industrial class. Collaboration between schools and industry in learning requires continuous support in order to create learning goals that are aligned with the expectations of the industrial community (Romadin, 2018; Umeda et al., 2022; Yoto et al., 2022).

2. Input Components

Evaluation of the input component that shown on table 8, which consists of five indicators, namely: (1) planning teaching factory activities, (2) teacher readiness, (3) student readiness, (4) facilities and infrastructure, and (5) financing. These five aspects received a suitable category, with a total score of 63.7 out of a total ideal score of 76, a percentage of 83.7%. Results of evaluation questionnaires on input components in the implementation of teaching factory learning in vocational schools.

Table 8. Evaluation Results on Input Components

Component	Aspect	N Average	N Max	%	Category
Input	Activity Planning	6	15	40	Not good enough
	Teacher Readiness	9,67	10	97	Very Good
	Student Readiness	18	20	90	Very Good
	Financing	14	15	93	Very Good
	Facilities and infrastructure	16	16	100	Very Good
	Total Score	**63,7**	**76**	**83,7**	**Good**

Planning activities in implementing teaching factory learning depends on the management that has been carried out. If teaching factory management has been done well, including planning, organizing, implementing, and supervising, this can be done professionally. Management of a program includes planning, organizing, mobilizing, and controlling actions to determine and achieve goals using human resources and other resources (Oktafiyah, 2020).

Aspects of teacher readiness in the Vocational School agribusiness food crop and horticulture skills program, information was obtained that productive teachers are by the DPSMK guidelines that the educational qualification of a teacher is a Bachelor's degree and has taken part in the Teaching Professional Program (PPG) which is linear to their educational background. All productive teachers have more than 2 years of teaching experience, and several productive teachers have had the opportunity to intern in the industrial world according to the required skills. Aspects of a teacher's professionalism include good teaching skills, in-depth subject knowledge, effective classroom management, regular learning evaluation, community involvement, continuous professional development, high professional ethics, and collaboration with colleagues (Bathmaker, 2013;

Mamlakah, 2023; Yusuf & Mukhadis, 2018). This reflects the teacher's dedication to providing quality learning and supporting students' development.

Aspects of students' readiness were explored through interviews with the head of the Agribusiness, Food Crops, and Horticulture expertise program at Vocational Schools. Information was obtained that the entrepreneurial mentality of all students had been formed through entrepreneurship subjects. Then, coupled with the teaching factory learning model, the entrepreneurial mentality will be even better prepared to enter the world of work. Apart from that, productive teachers play a role in forming students' self-confidence by providing examples of tool operation and understanding each production process according to the steps in the teaching factory module. During practice, students must understand each step and receive a good assessment from the supervising teacher before proceeding to the next step. Learning implementation must be able to know and understand the characteristics of students so that teachers can design a learning implementation plan with methods and media that can make learning more meaningful (Leal et al., 2020; Rejeki & Kuat, 2023; Suswanto & Adhikari, 2024).

Financing in the process of teaching factory learning activities has a vital role in expediting educational activities; with financing, it is hoped that educational activities can run smoothly without obstacles; financing is also an essential factor in achieving educational goals: superior quality education, of course, requires balanced financing. The results of the study state (Dwijayanthi & Rijanto, 2022; Yoto & Widiyanti, 2017) that the role of financing can improve educational services for the better and achieve high-quality education. Schools have the authority to manage education financing policies by the standards contained in the technical instructions for using the financing budget. Standardizing existing technical guidelines allows each educational unit to adopt appropriate and efficient financing budget policies to achieve the expected educational goals (Ananta et al., 2023; Harlianingtyas et al., 2024).

The Teaching Factory program can run if the facilities and infrastructure owned by the school meet the standards for carrying out production activities in the form of goods or services by the educational program it has. The results of a study (Wahjusaputri et al., 2020) state that 60-70% of the facilities and infrastructure owned by schools that implement teaching factory learning are used for business/production activities. The standards issued by the Directorate of Vocational Schools Education state that the facilities and infrastructure that Vocational Schools must have are standard training workshop facilities, advanced training workshops, and teaching factories (DPSMK, 2018). The facilities in the standard training workshop are the minimum standards that must be had in order to carry out learning activities by the curriculum; the advanced training workshop is a place to carry out learning activities, while the teaching factory is a facility specifically for production activities in the form of goods and services jasa (Balve & Ebert, 2019; Roll & Ifenthaler, 2021).

3. Process Components

Evaluation of the process component consists of four indicators just shown on table 9, namely: (1) scheduling, (2) teacher performance, (3) teacher activity, and (4) student activity, getting a percentage score of 86.3% or good category. Results of evaluation questionnaires on process components in implementing teaching factory learning.

Tabel 9. Evaluation Results on Process Components

Component	Aspect	N Average	N Max	%	Category
	Learning Scheduling	32	40	79	Good Enough
	Teacher Performance	3	3	100	Very Good
Process	Teacher Activities	3	3	100	Very Good
	Student Activities	183	210	82,5	Good
	Total Score	**221**	**256**	**86,3**	**Good**

In the scheduling aspect, students only get some teaching factory learning materials, starting from preparation, production steps, packaging, use of supporting equipment, and sales. In the aspect of student preparation, all students are declared competent in the areas of expertise they have. This is due to the ability and self-confidence to master all production steps, starting from land preparation, garden decoration techniques, cultivation techniques, packaging, and marketing of production results.

The principle of complete learning has been well accommodated in teaching factory learning. All materials are presented, starting with preparation, materials, production process, packaging, and marketing. However, problems occurred in practice due to incomplete equipment, causing schools only to use existing equipment. The evaluation was conducted to check the extent of synchronization between teaching factory learning scheduling and other learning in the class. Teaching factory learning shows that adaptive/normative subjects collaborate with entrepreneurship learning. All learning is organized using a block system. In order to maintain the continuity of teaching factory learning, students are involved intensively, taking part in bazaars or events related to synchronized subjects, as well as conducting online and offline sales to market learning outcomes. Each student also makes a final report to assess teaching factory learning outcomes.

The research results carried out by researchers regarding the above components are generally based on the work plan; the RPP that has been created is relevant to the teaching factory learning objectives, and productive teachers in teaching factory learning have also prepared assessment tools and modules. RPPs for teaching factory learning are used in productive subjects such as hydroponics, tissue culture, and vegetable and fruit cultivation.

Overall, the aspects of teacher activity during teaching factory learning are adequate, as can be seen in each teacher's performance when teaching factory learning, which is good. Research results (Dahl et al., 2023; Patria et al., 2024; Yoto et al., 2024) state that the critical role of teachers in implementing Teaching factory learning must have industrial skills developed through industrial internships, in addition to ensuring teacher competency, a teacher must have educational qualifications that are linear to the study programs available at vocational schools.

The results of the study showed that the implementation of Teaching Factory in SMK, especially in the Agricultural Technology department, succeeded in creating an active and dynamic learning environment with students playing the role of professional workers. In this model, students are directly involved in various agricultural production and processing activities, such as processing raw materials into food products or managing horticultural cultivation using the hydroponic method, from the planning stage to packaging and marketing according to industry standards. This process not only develops their technical skills but also important soft skills such as responsibility, discipline, collaboration, and awareness of sustainability through environmentally friendly waste management.

The implementation of teaching factory learning can improve good competence because teachers use varied methods in learning activities, the material in class is delivered to the same job sheet as the standards in the business world, it is easy to understand, the practical work carried out by students can produce good quality output. It requires the performance of teachers who can condition students' practical work and practice their skills; the facilities provided can be used as well as possible. The time allocation provided is based on the needs of each subject. These findings are confirmed by research conducted by (Asriati et al., 2018; Rasovska et al., 2022; Richert, 2023), which shows that teaching factories can contribute to increasing the competency of vocational school students by providing practical conditioning for students to provide good quality output results.

4. Product Components

Evaluation of the product component consists of two indicators: (a) learning outcomes and (b) teaching factory learning outcomes, getting a percentage score of 83.4% or a good assessment category. Discussing the production results, all student production is marketed within the school environment and purchased by teachers and the community around the school. Meanwhile, for service production, students usually promote it by renting it out to various groups, both formal and non-formal events. Results of evaluation questionnaires on product components in the implementation of teaching factory learning in vocational schools that shown on table 10.

Table 10. Evaluation Results on Product Components

Component	**Aspect**	**N Average**	**N Max**	**%**	**Category**
Product	Learning outcomes	178	210	84	Good
	Teaching Factory Learning Outcomes	14	20	70	Good Enough
	Total Score	192	230	83,4	Good

The results of the study indicate that the evaluation of Teaching Factory in SMK at the product component stage includes an assessment of the quality of the final product (Fig. 2), relevance to industry needs, and efficiency of production time and costs. In addition, the assessment also includes aspects of creativity, innovation, and students' ability to utilize the latest technology and production techniques. Customer or client satisfaction, which is often the end user of the product, is also an important indicator. Aspects of teamwork and communication in the production process are evaluated to ensure students are familiar with industrial work culture. Equally important, assessments are made on compliance with work safety (K3) procedures and waste management for environmental sustainability. This evaluation aims to enable students to produce quality products that meet industry standards while preparing them for the challenges of the world of work.

Fig 2: SMK Product A (a), SMK Product B (b)

Evaluation of learning outcomes in the teaching factory using the skills competency test. (Tungkasamit et al., 2014). The final score of the student competency test is a combination of theoretical and practical scores in teaching factory learning, with a theoretical comparison score of 30% and a practical score of 90%. This is in line with research results (Giatman, 2024; Saputro,

2024) that schools that can implement teaching factory-based learning to achieve the goal of increasing student competency starting from making learning implementation plans, the methods used must be able to encourage students to be more active in learning participation.

The results of the teaching factory learning at SMK A include seedlings, vacuum-packaged snack foods, and handicrafts made from banana stems. SMK b produced products in the form of ornamental plants, marigold tea, and vegetable cultivation using hydroponics and raised beds. The products resulting from this learning are not only concrete evidence of students' ability to apply the knowledge and skills they learn but also accurate indicators of the quality of learning at school (Patria et al., 2024; Wong et al., 2014). Through these products, students can see the results of their efforts and hard work, which provides a strong sense of accomplishment and pride. Apart from that, these products can also be a means of developing students' entrepreneurial skills, both in terms of product marketing and business management (Isnantyo et al., 2024; Kuat, 2023; Tjiptady et al., 2020).

Conclusion

Based on the results of evaluation research on the implementation of the teaching factory learning model in the food crop and horticulture agribusiness skills program at SMKN A, which was carried out in collaboration with industry, and B, which was carried out independently, conclusions can be drawn as follows: Evaluation of the context, input, process, and product components shows results which were good with percentages of 85.4%, 83.7%, 86.3%, and 83.4% respectively. This evaluation covers the formal basis of the teaching factory, principal policies, activity planning, student readiness, financing, teacher readiness, facilities and infrastructure, learning schedule, teacher performance, teacher activities, student activities, learning outcomes, and teaching factory learning outcomes. The data showed the effectiveness of practical learning in achieving vocational education goals.

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