



Implementation of Deep Learning through Cross-Subject Collaboration in the Crop Agribusiness Expertise Program: A Qualitative Study in Barru Regency

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ABSTRACT

Learning in Vocational High Schools (SMK) still faces challenges in integrating general and productive subjects, resulting in partial learning and not fully providing meaningful learning experiences. This study aims to explore the implementation of in-depth learning through cross-subject collaboration in the Plant Agribusiness Expertise Program at SMK Negeri 4 Barru and SMKS Islam Pesantren Alam Indonesia, Barru Regency. The study used an exploratory qualitative approach and was conducted from October 2025 to March 2026. Twenty-eight informants, consisting of two principals, 12 teachers, and 14 students, were selected purposively. Data were collected through participant observation, in-depth interviews, and documentation studies, then analyzed using the interactive model of Miles, Huberman, and Saldaña through data condensation, data presentation, and drawing and verifying conclusions. The results of the study show four main findings. First, in-depth learning is implemented through collaboration between productive subjects with Mathematics, Indonesian, and English in project-based learning. Second, students are actively involved in every stage of learning, from project planning to presentation of results. Third, teacher competence and collaboration, principal support, student motivation, and the utilization of the learning environment are supporting factors, while limited facilities and infrastructure, time allocation, and the preparedness of some teachers are inhibiting factors. Fourth, the implementation of immersive learning results in a conscious, meaningful, and enjoyable learning experience and develops students' critical thinking, communication, collaboration, creativity, and independence skills. These findings provide an empirical contribution to the development of immersive learning in vocational education.



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INTRODUCTION

Vocational education own role strategic in prepare source Power human beings who have competence in accordance with the increasing needs of the world of work complex. Vocational education No only aim produce graduates who have skills technical *skills*, but also building ability think critical, creativity, communication, collaboration, problem solving problems, and ability adapt to change environment work. Change needs of the world of work show that graduate of education vocational need own skills technical at a time transversal skills to be *able* to face development technology, change social, and demands future professionals (*OECD Skills Outlook 2023, 2023*) In the Expertise Program Crop Agribusiness, competency graduate of No only related with ability do activity cultivation plants, but also includes ability analyze problem production, processing information, utilizing technology agriculture, developing innovation products, as well as manage activity entrepreneurship based agriculture.

The transformation of 21st-century competency needs is driving vocational education to make changes in the learning process. Vocational high schools (SMK) are no longer solely focused on delivering material and mastering procedural skills, but need to provide learning experiences that enable students to understand the relationship between concepts, practices, and real-world problems. A contextual learning approach is needed to enable students to connect academic knowledge with real-world situations, enabling them to acquire competencies that are not merely theoretical but applicable in a variety of settings. Modern vocational education needs to develop experiential learning,

collaboration, and problem-solving skills to enable students to develop competencies relevant to the needs of the workplace (Choy et al., 2018; UNESCO, 2022).

In line with policy (Kementrian Pendidikan Dasar dan Menengah Republik Indonesia, 2025) about strengthening quality learning, approach Learning Deep *Learning* is developed as approach pedagogical that emphasizes learning conscious, meaningful and joyful. Approach This directed for create experience learning that enables students to understand draft in a way more-deep, connecting knowledge with experience real, and develop competence in a way Holistic. Deep learning is not only oriented towards mastering material, but also emphasizes the process of building conceptual understanding, connecting knowledge with real-life experiences, reflecting on the learning process, and applying knowledge to solve authentic problems. This approach encourages active student engagement through meaningful, collaborative, and learner-centered learning experiences (UNESCO, 2022); (OECD Skills Outlook 2023, 2023).

In context education, learning deep *learning* has different meanings with term *deep learning* in the field intelligence artificial intelligence (*artificial intelligence*). Learning deep is approach learning that emphasizes the process of understanding draft in a way whole, connecting various knowledge, doing reflection, as well as use knowledge the for-finish problem authentic. Approach This place students as actor main in process Study through activity exploration, collaboration, problem solving problems, and implementation knowledge. Andayanie, (2025) explain that learning deep in education experience - oriented Study reflective, contextual, and student -centered through involvement aspect cognitive, social, and emotional. In line with matter the, (Siregar & Fauzan, 2025) show that principle *mindful*, *meaningful*, and *joyful learning* capable support more learning active and relevant with need participant educate.

Implementation learning depth is very relevant to education vocational Because characteristics Vocational school learning emphasizes connection between theory and practice. In the Expertise Program Crop Agribusiness, settlement problem agriculture needs integration various discipline science. Subjects' mathematics play a role in activity measurement land, calculation need seeds, dosage fertilizer, analysis production and management effort. The Indonesian language subject supports ability compile report practices, activity proposals, and documentation results learning. Meanwhile that, English support ability communication professional, compilation information products and promotional media development Agribusiness. Integrating productive and general subjects allows students to build relationships between concepts, making learning more contextual and supporting the development of competencies and problem-solving skills relevant to the world of work (Suputra et al., 2024).

One of the strategies that supports implementation learning deep is learning based Project - *Based Learning* Approach This give chance to students to Study through experience authentic with involves the identification process problems, planning activities, implementation project, presentation results and reflection learning. Learning based project own suitability with principle learning deep Because give room for students to experience an active, reflective, collaborative and productive learning process product real. Research (Akhyar et al., 2024) show that development learning-based problems and projects in education vocational capable increase quality of the learning process through activity settlement problems and involvement active participant educate. Besides that, (Rafli Abdillah & Budi Wiyono, 2024) show that implementation *Project-Based Learning* in Schools Intermediate Vocational can support improvement competence participant educate through experience contextual learning and oriented to the needs of the world of work.

Learning deep through collaboration cross eye lessons also have relatedness with development eight dimensions profile graduates, namely faith and piety, citizenship, collaboration, independence, reasoning critical thinking, creativity, health, and communication. Integration of learning the allows students not to only get skills technical agribusiness, but also develop ability social, character, and skills 21st century needs in face changes in the world of work. An integrated approach knowledge, skills, and character become one of the important strategies in increase quality graduate of education vocational (OECD Skills Outlook 2023, 2023).

Study This conducted at Vocational Vocational Schools Agribusiness Plants in the Regency Barru, namely at SMKS Islam Pesantren Alam Indonesia and SMKN 4 Barru which have characteristics learning based practice field. Learning in the field Agribusiness Plant involving activity cultivation plants, management results agriculture, as well as development project entrepreneurship. Based on observation beginning research, there are need For strengthen connectedness between learning productive and eye lesson general so that students are able see connection between draft academic and experience practice vocational school Agribusiness Plants in the Regency Barru own environment supportive learning development competence based practice through activity production plants, management land and activities entrepreneurship agriculture. Characteristics the give opportunity implementation learning deep because of the learning process no only ongoing through delivery knowledge, but also through experience direct, solution problems, collaboration, and reflection to activity practice.

Study previously shows that innovation learning in education vocational has Lots developed through integration curriculum, learning based Project - *Based Learning*, and the *Teaching Factory model*. Research (Suputra et al., 2024) show that transformation curriculum that integrates learning with experience Work capable increase experience learning, student competencies, and interactions learning in education vocational. In addition, (Akhyar et al., 2024) report that development syntax learning based problems and projects capable increase quality of the learning process through activity solution problems, collaboration, and engagement active students. Although thus, some big study the Still focused on development device learning, improvement results study, or effectiveness of learning models certain. Reviewed studies how is the eye teacher lesson general and eye teachers lesson productive collaborate in integrate competence cross eye lessons in the learning process Still relatively limited.

In addition, various study regarding the *Teaching Factory* model show that approach This capable increase skills practice, competence professionalism and readiness student work through experience learning that resembles the work process in industry (Yoto et al., 2024). Findings the reinforced by (Saputro, 2024) the explainer that *Teaching Factory* is a learning model integrated vocational *Project-Based Learning* and *Work-Based Learning* For produce experience learning that is authentic and oriented towards the needs of the world of work. However, some big study the Still evaluate success *Teaching Factory* based on achievements competence technical, productivity, or readiness work. Aspect learning in-depth which includes the process of student reflection, meaning experience learning, engagement active in learning, relatedness between competence academic and competency vocational, as well as factors contextual influences its implementation in the Expertise Program Agribusiness Plant Still Not yet Lots reviewed. Therefore that, research This directed for answer how teachers plan and implement learning deep through collaboration cross eye lessons, how student involvement during the learning process ongoing, factors What only those that support and hinder implementation learning deep, and How meaning learning the to development student competencies.

METHOD

Study This use approach qualitative with design exploratory for explore in a way deep practice learning depth (*deep learning*) on the eye lesson productive Agribusiness Collaborated plants with eye lesson common in schools Intermediate Vocational School (SMK) Regency Barru. Approach This chosen Because study focus on understanding to the process, experience, interaction, factors supporters and inhibitors, as well as meaning implementation learning deep in context real learning so that the phenomenon being studied No can explained only through approach quantitative.

Study will be held from October 2025 to March 2026 at State Vocational School 4 Barru and Islamic Vocational School Pesantren Alam Indonesia. school chosen in a way purposive Because has implement learning deep through collaboration between eye lesson productive Agribusiness Plants and eyes lesson general so that in accordance with objective research. Unit of analysis in study This is practice learning in depth on the Skills Program Agribusiness Plants in both schools, with comparing implementation processes, student involvement, factors supporters and inhibitors, as well as meaning learning that emerges in each context school.

Informant study consisting of 28 people over 2 heads school, 12 teachers, and 14 students. Informant chosen use technique *purposive sampling* based on criteria involvement in a way direct in implementation learning in-depth. The selected teacher includes productive teachers Agribusiness Plant and subject teachers lesson Mathematics, Indonesian, and English are involved in learning collaborative. Students who become informant are students in grades XI and XII of the Expertise Program Agribusiness Plants that have been follow learning collaborative cross eye lesson. Selection informant done after get permission from party school and willingness informant for participate in a way voluntary in study. To maintain the confidentiality of informant identities, each informant was given a code as presented in Table 1. This code was used consistently in the research results section.

Table 1. Profile and School Affiliation of Research Informants

Informant Code	Category Informant	Which school are you from
KS1	Headmaster	State Vocational School 4 Barru
KS2	Headmaster	Islamic Vocational School of Islamic Boarding School of Nature of Indonesia
SMKN4-P1	Productive Teacher Agribusiness Plant	State Vocational School 4 Barru
SMKS-P1	Productive Teacher Agribusiness Plant	Islamic Vocational School of Islamic Boarding School of Nature of Indonesia
SMKN4-MTK1	Math teacher	State Vocational School 4 Barru

Informant Code	Category Informant	Which school are you from
SMKS-MTK1	Math teacher	Islamic Vocational School of Islamic Boarding School of Nature of Indonesia
SMKN4-BI1	Indonesian Language Teacher	State Vocational School 4 Barru
SMKS-BI1	Indonesian Language Teacher	Islamic Vocational School of Islamic Boarding School of Nature of Indonesia
SMKN4-BING1	English teacher	State Vocational School 4 Barru
SMKS-BING1	English teacher	Islamic Vocational School of Islamic Boarding School of Nature of Indonesia
M1–M14	Students of Class XI and XII Agribusiness Plant	Second school

Source: Results of research data analysis (2026).

Based on table above, the instrument main study is researchers (*human instruments*) supported by guidelines semi- structured interviews, questionnaires observation, and sheets documentation. Guidelines interviews and observations arranged based on focus research, then reviewed by lecturers' mentor For ensure its suitability with objective study before used in data collection. In study this, researcher play a role as instrument the main ones involved in a way direct in all over stages research, starting from data collection, analysis, to interpretation results with still guard objectivity through the process of triangulation and *member checking*.

Data collected through observation, interview in-depth, and study documentation. Observation done on more from One meeting learning for get description about planning and implementation learning in-depth, learning strategies, collaboration between teachers, student involvement, factors supporters and inhibitors implementation learning, as well as meaningfulness learning experienced by students. Interview deep done to head schools, teachers, and students with duration about 30–60 minutes each informant for dig experience, perception, and meaning learning the depth that they natural. Documentation study done to teaching modules, devices learning, documents curriculum, sheets student work, results learning, and document school other related matters with implementation learning deep.

Data collection was carried out in a way gradually during period study with consider adequacy information obtained from every informant. The data collection process was stopped when information obtained show repeating patterns, no found category and theme new, and all over focus study has answered in a way adequate. In the condition the data is assessed has reach saturation (data saturation), namely condition when additional data collection No Again produce information new meaning for development theme study (Saunders et al., 2018) With Thus, the number informants involved viewed has adequate for give comprehensive understanding about implementation learning in depth on the Skills Program Agribusiness Plants in both schools.

Data validity is maintained through triangulation sources, triangulation technique, triangulation time, and member checking. Triangulation source done with compare information obtained from head school, teachers, and students. Triangulation technique done with compare results observation, interviews, and documentation, while triangulation time done through data collection on several stage during period research. Next, member checking done with confirm return summary results interview to a number of informants for ensure suitability between results interpretation researchers and experiences conveyed by informants.

Study This implemented after get permission from second school as location research. Before process Data collection was carried out throughout informant given explanation about objective research and asked state his willingness for participate in a way voluntary. For guard confidentiality, identity informant disguised use code in the analysis process and reporting results study.

Data analysis used an interactive model (Miles et al., 2014) that included data condensation, data presentation, and drawing and verifying conclusions. The analysis process began with transcribing all interview results, compiling observation notes, and organizing research documents. Next, inductive *open coding was conducted* to identify codes that emerged from the data without establishing rigid categories from the outset. Related codes were then grouped into several categories and further developed into research themes. Byrne, (2022) During the analysis process, researchers continuously compared data from observations, interviews, and documentation to ensure consistency of findings. Interpretations were also confirmed through *member checking* with several informants so that the themes obtained accurately reflected the informants' experiences and perspectives. Next, the data were presented in the form of descriptive narratives and a thematic matrix before drawing and verifying conclusions repeatedly until consistent findings were obtained (Miles et al., 2014).

RESULTS

1. Planning and Implementation Practice Learning Deep

Research result show that learning in depth on the Skills Program Agribusiness Plants at State Vocational School 4 Barru and Islamic Vocational School Pesantren Alam Indonesia were implemented through collaboration between eye lesson productive with eye lesson general, namely Mathematics, Indonesian, and English. Based on results observation and study documentation, collaboration the has designed since stage planning learning through compilation teaching tools in general together, alignment achievements learning, determining learning strategies, and compilation customized assessment with implementation project learning.

Observation results show that process learning implemented use various strategies, such as *Project-Based Learning* (PjBL), discussion groups, and practices directly on the land. This strategy give chance to students to involved active in identify problems, compiling plan work, carry out practice cultivation plants, processing the results data practice, compose reports, and present results project. All stages learning ongoing in a way sequentially so that students follow the learning process start from planning until evaluation. Productive teacher at State Vocational School 4 Barru (SMKN4-P1) explained:

"Through use of Project-Based Learning, discussion groups, and practices directly in the field, students become more active ask, discuss, work the same, and capable connect material studied with condition real on the ground."

The results of the observation also show existence integration competence between eyes lesson during implementation project cultivation plants. Subject productive play a role in guide students in activities mapping land, nursery, planting, maintenance plants, harvest, and post-harvest. Subjects Mathematics integrated in calculation need seeds, dosage fertilizer, area land, analysis cost production, and estimates profit business farmer. Indonesian is used in compilation report practice, delivery results discussion and presentation project, while English implemented through use vocabulary agriculture and preparation of promotional media simple for support marketing results harvest. Findings interview show that the teacher views collaboration cross eye lesson help students connect draft academic with practice Vocational. English teacher of State Vocational School 4 Barru (SMKN4-PUB) said:

"Collaboration learning make students more creative, more communicative, capable Work The same in team, and understand relatedness between eye lesson general with eye lesson productive."

In addition, the results observation show that teachers are more Lots play a role as facilitator during the learning process. Students are given chance for identify problem, discuss in group, determine alternative completion, implementation field practice, as well as do reflection to results learning. Conditions the show that the learning process give room to students to participate active in accordance with duties and responsibilities answer each one. Productive teacher at the Indonesian Natural Islamic Boarding School Vocational School (SMKS-P1) said:

"Environment fun, sporty learning, and give room to students to growing very influential involvement they during learning. Students who follow learning without pressure seen more enthusiastic in learn and more active during activity practice."

To maintain the confidentiality of the informant's identity, each informant is given a code as presented in

Table 2. The codes are used consistently in the research results section.

Theme	Subtheme	Data source	Proof
Planning	Compilation teaching tools	Observation, Documentation, Teacher	SMKN4-P1; SMKS-P1
Implementation	Project-Based Learning	Observation	Second school
Eye integration lesson	Productive Lessons, Mathematics, Indonesian, English	Observation, Interview	Teacher & Student
The role of teachers	Facilitator learning	Observation, Interview	SMKN4-PUB; SMKS-P1

Source: Results of research data analysis (2026).

Based on the table above, in general general, results observation, interviews, and documentation show that learning deep in both schools designed through collaboration cross eye lessons and implemented through learning-based projects that integrate competence academic with competence vocational in activity learning Agribusiness Plant.

Findings study show that practice learning in depth on the Skills Program Agribusiness Plants at State Vocational School 4 Barru and Islamic Vocational School Pesantren Alam Indonesia are designed through collaboration between eye lesson productive and eye lesson general since stage planning learning. Collaboration the No only done in compilation teaching tools, but also through alignment achievements learning, determining learning strategies, and compiling supportive assessment implementation project. Planning carried out in a way collaborative allows every eye lesson give contribution in accordance his competence so that learning become more contextual and integrated.

Findings the show that learning No Again implemented in a way separated based on discipline science, but directed for build relatedness interconcept through experience authentic learning. Integration between eye lesson productive with Mathematics, Indonesian, and English give chance to students to apply knowledge academic in settlement problem real in activities cultivation plants. Conditions This show that competence academic functioning as supporters achievement competence vocational so that students get experience learn more intact.

Implementation learning through *Project-Based Learning* also shows that students are involved in a way active start from identification problem, compilation plan work, implementation practice, data processing, compilation reports, up to presentation results project. Student involvement in every stage the indicates that the learning process give room for students to build knowledge through experience direct, collaborative, and reflective to results learning gained.

Findings study This in line with (Andayanie, 2025) which explains that learning deep place students as subject active in the learning process through experiences that are reflective, contextual, and student- centered. In study this, characteristics the looks through student involvement in all over stages project as well as chance for connect draft academic with practice vocational. In addition, (Siregar & Fauzan, 2025) state that implementation principle *mindful*, *meaningful*, and *joyful learning* give experience learn more meaningful because students are involved in a way active in understand, apply, and reflect knowledge gained.

Research result this is also in line with (Taufik et al., 2025) which explains that integration principle learning deep in *Project-Based Learning* encourage students to construct knowledge through project real, reflection sustainable, and collaborative. In research this activity practice cultivation plant become a medium for students to connect draft from various eye lesson in finish problems faced during the cultivation process. With Thus, the project No only functioning as activity practice, but also as vehicle integration competence academic and competency vocational.

When compared with study previously, some big study about learning based projects on education vocational more Lots focus on improving results Study or competence technical participant educate. On the other hand, research This show that implementation learning deep no only related with implementation project, but also involves a collaborative process between teachers since stage planning until evaluation learning. Findings This give description that success implementation learning in -depth education vocational influenced by integration between planning collaborative, implementation learning based projects, as well as integration competence academic and vocational in one learning process.

2. Student Involvement in the In-Depth Learning Process

Research result show that students at State Vocational School 4 Barru and Islamic Vocational School Pesantren Alam Indonesia are involved in various activities stages learning in-depth implementation through collaboration eye lesson productive Crop Agribusiness, Mathematics, Indonesian, and English. Based on results observation, student involvement is visible since stage planning project, implementation practice cultivation plants, processing of data results observation, compilation reports, up to presentation results project. During activity in progress, students discuss in group, divide task in accordance not quite enough answer each, do field observations, as well as communicate with the teacher when face constraint in implementation project.

Students of SMKS Islam Pesantren Alam Indonesia (SMKS-M1) revealed that integrated learning a number of eye lesson make it easier they understand connection between material studied in class with activity field practice.

" Combining learning a number of eye lesson make I more easy understand connection between theory and practice, as well as more challenged in do task Because must combine various concept." (SMKS-M1)

Statement the show that students look at collaboration cross eye lesson help they connect draft from various discipline knowledge in finish task project cultivation plant. Findings similar obtained from students of State Vocational School 4 Barru (SMKN4-M1) who stated that involvement some teachers in One activity learning give chance get directions from various field skill .

" Interaction with the teacher to be more often Because get directions from several teachers at once, so that more helped in understand assignment." (SMKN4-M1)

Observation results support statement said. During practice cultivation plants, pupils visible active discuss with productive teachers and subject teachers lesson general when determine step work, do measurement land, arranging reports, and prepare presentation results project. Interaction the ongoing throughout process learning and not only when the teacher delivers material. Productive teachers of SMKS Islam Pesantren Alam Indonesia (SMKS-P1) also observed that more student involvement seen when learning done through activity practice.

"The students are seen more enthusiastic when learning done through practice direct Because they can see and experience the process itself that is being studied." (SMKS-P1).

The same observation delivered by a productive teacher at State Vocational School 4 Barru (SMKN4-P1) who explained that

"More students active submit questions, discussion in groups, as well as presenting results work when every eye lesson give contribution in accordance his competence in project cultivation plant ".

Table 3. Summary of Findings on Student Engagement in Deep Learning

Subtheme	Observation	Interview	Documentation
Participation in discussion	Active students discuss determine step work and solve problem during project.	The student stated discussion help understand connection theory and practice (SMKS-M1).	Notes observation and photography discussion group.
Involvement in practice	Students carry out cultivation plants, observations, and recording results.	The teacher explains to the students more enthusiastic moment practice direct (SMKS-P1).	Practice photos, sheets observation plant.
Collaboration with the teacher	Students consult with productive teachers, Mathematics, Indonesian, and English during project.	The student stated get directions from some teachers so that more understand assignment (SMKN4-M1).	Collaboration schedule, documentation mentoring.
Compilation product learning	Students compose reports, promotional media, and presentations results project in a way in groups.	The teacher observes that students are able to presenting results work in accordance distribution task.	Report practice, promotional media, materials presentation.
Variation involvement	Some students are active lead discussion, whereas some students still need directions at the stage beginning activity.	The teacher explains level different student participation in accordance experience and trust self.	Notes field results observation.

Source: Results of research data analysis (2026).

Based on the table above, student engagement at both schools was evident throughout all stages of in-depth learning, from project planning to the development of learning products. All three data sources-observations, interviews, and documentation-showed a consistent pattern of student participation in discussions, fieldwork, report preparation, and project presentations. However, observations also revealed variations in student participation levels, particularly in the early stages of project implementation, when some students still needed guidance from teachers or group members before engaging more actively.

Findings study show that student engagement grows through experience learning that places students as perpetrator main in learning. Student participation is not only seen in the implementation practice cultivation plants, but also in the process of identifying problems, discuss in group, connecting draft from various eye lessons, composing reports, and present results project. The pattern show that student engagement is formed through experience active, collaborative, and contextual learning so that students have chance for build his understanding based on experience gained during the learning process. Findings the in harmony with study (Giri Aditama et al., 2025) who reported that implementation learning in -depth learning Language English in vocational schools is encouraged student engagement through activity collaborative, problem solving problems, creativity, and application related tasks with the real world.

Research it also shows that the teacher views student engagement is not only shown by activity follow learning, but also through involvement cognitive, emotional, and social during the learning process.

Research result this is also in line with study (Putra et al., 2025) who found that learning based project play a role in building learning processes in depth in vocational school because give chance to students to connect concepts learned with practice real in accordance field expertise. Through authentic projects, students gain experience learning that encourages involvement in the process of thinking, working the same, and reflect results work that has been conducted. Student involvement found in the study This is also supported by the implementation projects that integrate a number of eye lessons. The integration allows students to use draft Mathematics For do measurement and data processing, Indonesian for compile report practice, English for convey information about results cultivation plants, as well as eye lesson productive as base implementation practice in the field. Conditions the show that learning ongoing in a way integrated so that students get experience learn more intact compared to when every eye lesson studied in a way separated.

Interpretation the supported by research (Akhyar et al., 2024) which explains that syntax learning based projects on education vocational give room for students to designing solutions, develop project, and present the result in a way collaborative. Stages the give chance to students to involved in a way active since planning until evaluation project so that learning become more meaningful. In addition, research (Dewi et al., 2025) show that approach integrated *deep learning* with *Problem-Based Learning* in education vocational give chance to students to participate more active in finish problems, develop resolution strategies, and build understanding through experience learn. Although study the use approach quantitative, the findings strengthen interpretation that activity demanding learning involvement direct give experience learn more deep for students.

Findings study this also shows that student engagement is not ongoing in a way uniforms. Some students participated active since stage beginning project, whereas part other need teacher mentoring and support Friend a group before capable contribute in a way more independent. Variation the indicates that student engagement is influenced by experience learning, trust self, as well as dynamics Work group. These results consistent with study the latest that emphasizes that learning strategy deep need accompanied by teacher mentoring, differentiation, and collaboration so that all students have chance participate optimally in the learning process.

In a way overall, results study This indicates that student involvement in learning deep built through experience authentic, collaborative, and integrated learning. Engagement the reflected in student participation in the process of thinking, communicating, working the same, and produce product relevant learning with context vocational. With Thus, student involvement in study This understood as experience learning that develops through interaction between students, teachers, and the environment study, not as size effectiveness or improvement results shopping.

3. Supporting and Inhibiting Factors Implementation Learning Deep

Based on results observation, interviews, and studies documentation, implementation learning in depth on the Skills Program Agribusiness Plants at State Vocational School 4 Barru and Islamic Vocational School Pesantren Alam Indonesia are influenced by several factors. factor supporters and factors inhibitors. Supporting factors found covering teacher competence, collaboration inter- teacher support school, and student motivation. The factors inhibitor covering limitations facilities and infrastructure practice, limitations allocation time learning, as well as difference teacher readiness in develop learning collaborative.

Observation results show that productive teachers and subject teachers lesson common in both school compile device learning in a way together through determination theme project, preparation assessment, distribution roles, and adjustments achievements learning every eye lessons. During implementation learning, teachers help each other coordinate for integrate material productive with Mathematics, Indonesian, and English to in activity practice cultivation plant. productive teacher at the Islamic Vocational School of Pesantren Alam Indonesia explains:

"We are compiling learning together before activity started. Math Teacher help with calculations need seeds and fertilizers, Indonesian language accompaniment compilation report, while English introduce term technical agriculture." (SMKS-PUB)

Interview results also show that communication between teachers ongoing regularly before, during, and after learning through compilation timetable activities, distribution tasks, as well as evaluation implementation project. In addition, the head school give support through provision land practice and opportunity to the teacher to develop learning collaborative.

Although thus, there are difference condition between second school. At SMKS Islam Pesantren Alam Indonesia, teachers deliver that teacher's ability in integrate eye lesson has growing, but still need strengthening in compilation

more learning contextual. The teacher also explains that availability tool practices, learning media, and teaching materials are still limited so that its use need customized with condition school.

Table 4. Themes, Subthemes, Data Sources, and Empirical Evidence of Planning and Implementing Deep Learning

Theme	Subtheme	Data source	Example of Empirical Evidence
Supporting Factors	Teacher competency	Interview (SMKN4-P1, SMKS-P1), observation	Teachers develop learning tools, determine projects, and develop assessments collaboratively.
	Collaboration between teachers	Interview (SMKN4-MTK1, SMKN4-BI1, SMKN4-BING1, SMKS-MTK1, SMKS-BI1, SMKS-BING1)	The teacher coordinates before learning, divides roles, and evaluates project implementation.
Inhibiting Factors	School support	Interviews (KS1, KS2), documentation	The principal provides support through the use of practice areas and collaboration opportunities.
	Student motivation	Observation, interviews (M1–M14)	Students actively participate in practicals, group discussions, report preparation, and presentations.
	Facilities and infrastructure	Observation, documentation, interviews (SMKN4-P1, SMKS-P1)	Limited practical tools mean that the facilities have to be used alternately.
	Time Allocation	Teacher interview	Project-based learning requires more time for practice, reporting, and reflection.
	Teacher readiness	Teacher interview	Some teachers still need strengthening in developing integrated learning and project-based assessments.
Efforts to Overcome Obstacles	Coordination and utilization of facilities	Interviews, observations, documentation	The teacher prepares a schedule for the use of practical tools, divides student tasks, and provides guidance during the project.
Supporting Factors	Teacher competency	Interview (SMKN4-P1, SMKS-P1), observation	Teachers develop learning tools, determine projects, and develop assessments collaboratively.
	Collaboration between teachers	Interview (SMKN4-MTK1, SMKN4-BI1, SMKN4-BING1, SMKS-MTK1, SMKS-BI1, SMKS-BING1)	The teacher coordinates before learning, divides roles, and evaluates project implementation.

Source: Results of research data analysis (2026).

Based on table above, students in both school show participation active during activity practice cultivation plants. Students are involved in processing land, planting, observation growth plants, discussion group, arrangement reports and presentations results activity.

A student said:

"Studying in the garden more easy understood because we are direct practice material studied." (SMKN4-M1). On the other hand, research this also found a number of obstacles. Observation results show that amount tool available practices and materials Not yet fully sufficient when all over group carry out activity in a way simultaneously so that use facility done in a way alternate.

Productive teacher explains:

"If all class practice simultaneously, the tools available Not yet Enough so that must schedule take turns." (SMKN4-P1). Apart from the limitation's facilities, results interview shows that learning based project need more time long Because covers stage planning, implementation practice, preparation reports, presentations, and reflections. Some teachers also deliver that compilation device learning integrated and assessment-based project Still need mentoring.

On the other hand, some students need guidance more intensively in order to be able to participate optimally in activity group.

Implementation learning in depth on the Skills Program Agribusiness Plant show that teacher competence, collaboration cross eye lessons, support school, student motivation, and availability facilities and infrastructure is interrelated factors related in support implementation learning. Findings This show that learning in -depth education vocational need synergy between teachers and the environment schools, and resources Power learning for experience Study can ongoing in a way contextual in accordance with characteristics education vocational. Teacher competence is one of the factors important in implementation learning deep. The teacher's ability to design learning collaborative allows integration between eye lesson productive with eye lesson general so that students get experience learn more contextual. In learning deep, the teacher does not only play a role as transmitter material, but also as designer experience learning that connects draft academic with practice real. Findings This in line with (Darling-Hammond et al., 2024) which explains that teacher capacity in designing learning authentic and collaborative is one of the prerequisite important in implementation learning deep.

In addition to teacher competence, support the school also shows role important in implementation learning. The opportunities provided to the teacher to collaborate, utilize land practice, and support head school reflect existence culture supportive schools innovation learning. Conditions This in line with (Sumardi et al., 2025) that state that leadership school and culture collaborative give contribution to development learning in education vocational. On the other hand, research this also shows that limitations facilities and infrastructure, allocation time learning, as well as teacher readiness is still become challenge in implementation learning deep. Limitations facility practice cause use tool done in a way alternately, while learning based project need management more time flexible. These conditions indicate that the implementation of in-depth learning requires adequate support from facilities, planned time management, and continuous teacher competency development. The availability of facilities and infrastructure is one aspect that supports the implementation of learning, especially in practical activities that require appropriate tools, materials, and learning media. In addition, systematic management of facilities and infrastructure also supports the smooth running of the learning process through planning, utilization, maintenance, and evaluation of learning facilities. This finding is in line with (Vikasari et al., 2024) those that emphasize the importance of systematic management of facilities and infrastructure in supporting the quality of learning. Furthermore, (Meilinda & Saputra, 2025) it explains that the management of learning facilities and good time management are important aspects in supporting the implementation of the learning process effectively.

In a way overall, findings study This show that implementation learning in depth on the Skills Program Agribusiness Plant influenced by interactions between teacher competence, collaboration cross eye lessons, support school, student motivation, and management facilities and infrastructure. Although second school own characteristics and sources different power, implementation learning deep still can implemented through adjustment to conditions of each school. Findings This show that implementation learning in -depth education vocational need collaboration inter-teacher support institutional, as well as management source Power adaptive learning so that the experience contextual learning can realized.

4. Meaning Learning Deep to Development Student Competence

Findings study show that teachers and students at State Vocational School 4 Barru and Islamic Vocational School Pesantren Alam Indonesia interpret implementation learning deep as experience learning that connects material learning with practice real in the field Agribusiness Plants. Based on results observation, interviews, and documentation, integration between eye lesson productive, Mathematics, Indonesian, and English give chance to students to apply concepts learned in activity cultivation plants, arrangement reports, presentations results practice, and preparation of promotional media results harvest.

Observation results show that students are involved in every stages activity practice, start from preparation land, nursery, planting, maintenance plants, up to harvest and marketing results. During activity in progress, students discuss in group, divide task, identify problems that arise in the field, as well as determine alternative settlement based on results observation. Documentation learning show existence report practice, photo activities, promotional media, results cultivation plants, and presentation project as proof student involvement in the learning process. Productive teacher from State Vocational School 4 Barru explain that learning carried out through practice field help students understand connection between material studied with activity cultivation plant. One teacher said:

"Students are more understand material when they direct practice it on the land. They can see connection between theory and practice so that more easy explain return what has been studied." (SMKN4-P1)

Findings Similar results were also obtained at SMKS Islam Pesantren Alam Indonesia. Productive teachers convey that student engagement is visible when they discuss, work the same in groups, as well as finish task practice in accordance distribution not quite enough answer. The teacher explains:

" Through learning collaborative, students more active discuss and dare put forward opinion when finish activity practice together his group." (SMKS-P1)

Eye teacher lesson the general public also expressed that collaboration cross eye lesson give room for students to develop ability communication and literacy. Based on results observation, students compose report results practice use rules appropriate writing, presenting results projects ahead class, and use terms agriculture in English on promotional media results cultivation plant.

Students of second school give relative perception The same about experience learn what they get. Students convey that learning become more easy understood Because material No only studied through teacher's explanation, but also applied in a way direct in activity practice. However Thus, there are differences in implementation learning in both schools. At SMK Negeri 4 Barru, the activities practice supported by more facilities complete so that all over stages cultivation can implemented in a way more optimal. Meanwhile that, at SMKS Islam Pesantren Alam Indonesia, several activity practices customized with availability tools and materials so that the teacher does adjustment in implementation learning.

Table 5. Themes, Subthemes, Data Sources, and Empirical Evidence on the Focus of the Research on the Significance of Deep Learning

Theme	Subtheme	Data source	Empirical Evidence
Significance learning deep to development student competencies	Understanding conceptual	Observation, Interview of Productive Teachers (SMKN4-P1; SMKS-P1), Documentation	Students connect material cultivation plant with practice start from preparation land until harvest. The teacher stated that the students were more understand material after implemented in activity practice.
	Ability thinks critically	Observation, Student Interviews (M1–M14)	Students identify problem cultivation plants, discussing causes, and determine alternative settlement based on results field observations.
	Communication	Observation, Interview with Indonesian Language Teachers (SMKN4-BI1; SMKS-BI1), English Language Teachers (SMKN4-BING1; SMKS-BING1), Documentation	Students compose report practice, present results project, and use term agriculture in English on promotional media results harvest.
	Collaboration	Observation, Interview Productive Teachers, Students	Students working in group, divide assignments, discussions, and completion project cultivation plant in a way together.
	Creativity	Observation, Documentation	Students produce promotional media, reports practice and innovation simple in activity cultivation plant.
	Independence	Observation, Interview of Productive Teachers	Students complete task practice in accordance not quite enough answer without depends fully to the teacher.
	Competence vocational	Observation, Documentation, Interview of Productive Teachers	Students carry out stages cultivation plant start from preparation land, nurseries, planting, maintenance, harvesting, up to marketing results.
Significance learning deep to development competence students	Eight Dimensions Profile Graduate of	Observation, Documentation, Teacher Interviews	Identified dimensions faith and piety, citizenship, collaboration, communication, reasoning critical, creativity, health (K3), and independence during process learning ongoing.
	Understanding conceptual	Observation, Interview of Productive Teachers (SMKN4-P1; SMKS-P1), Documentation	Students connect material cultivation plant with practice start from preparation land until harvest. The teacher stated that the students were more understand material after implemented in activity practice.

Theme	Subtheme	Data source	Empirical Evidence
	Ability thinks critically	Observation, Interviews (M1–M14)	Student Students identify problem cultivation plants, discussing causes, and determine alternative settlement based on results field observations.

Source: Results of research data analysis (2026).

Based on table above, the results observation and documentation, implementation learning depth also shows development dimensions competence graduate of during the learning process. Dimensions collaboration looks when students work the same in group, dimension communication seen in activities presentation and preparation report, whereas dimensions reasoning critical appear when students identify problem cultivation plants and discuss alternative the solution. Creativity seen through preparation of promotional media results harvest, while independence reflected from students' ability to complete task in accordance not quite enough the answers given. In addition, the implementation of procedure Occupational Safety and Health (K3) during activity practice show attention to aspect health and safety Work in learning vocational. In a way overall, results observation, interviews, and documentation show that implementation learning deep perceived by teachers and students as experience learning that connects knowledge academic with practice vocational experience the give chance to students to apply knowledge, work the same in groups, communicate, and resolve task through appropriate activities with context learning in the Expertise Program Crop Agribusiness.

Findings study show that implementation learning deep through collaboration cross eye lesson perceived by teachers and students as experience helpful learning connect draft academic with practice in the Expertise Program Crop Agribusiness. Based on results observation, interviews, and documentation, students gain chance for apply knowledge through activity practice, discussion group, arrangement reports, presentations, and solutions project. Experience the show that learning No only focus on mastery material, but also provide room to students to build understanding through activity contextual learning. Findings the in harmony with (Fatihah et al., 2025) which explains that learning deep emphasizes *a* learning process that is mindful, meaningful and joyful. Through approach said, students do not only accept information, but build understanding through experience relevant learning with context life. In study this, the process seen when students connect material cultivation plant with activity practices in the field, so that concepts learned can understood through implementation direct.

Findings research also supports opinion (Rahmawati et al., 2025) that learning deep is an approach that develops students in a holistic manner holistic through integration knowledge, skills, character, and attitudes. Research results show that activity learning that involves eye lesson productive, Mathematics, Indonesian, and English give chance to students to develop ability communication, collaboration, reasoning critical thinking, creativity, and independence. This integration shows that learning in education vocational No only mastery-oriented skills technical, but also on development required competencies in facing the world of work.

In addition, the results study shows that learning integrated give chance to students to connect knowledge from various field in One context learning. Conditions This in line with (Li & Rohayati, 2024) which explains that learning based appropriate project and assessment strategies give chance to students to apply knowledge in situation authentic so that support development competence. In study this, the implementation the seen through activity compilation report practice, presentation results projects, as well as promotional media creation results cultivation plants that combine competence academic and vocational.

Findings research also shows that the teacher views learning deep as an approach that provides room for students to Study through experience directly. This in line with draft Deep (Fullan et al., 2020) *Learning* proposed by that learning deep emphasize experience authentic, collaborative, and student- centered learning. In the context of study this, learning No only ongoing through delivery material in class, but also through activity practice cultivation plants that allow students to connect knowledge with situation real in accordance field his expertise. Development ability think critical, communication, collaboration, creativity, and independence are found in study this also shows characteristics learning based experience. This supported by (Li & Rohayati, 2024) the explanation that learning based project give chance to students to develop ability apply knowledge, solving problems, and produce product learning. In study this, ability the seen when students identify problem in activity cultivation plants, do discussion group, determine alternative settlement, as well as carry out task in accordance not quite enough answer each one.

In a way overall, findings study shows that learning deep through collaboration cross eye lesson perceived as experience supportive learning development student competencies in education vocational experience the reflected through student involvement in activity practice, discussion, solution project, preparation reports, and presentations that connect knowledge academic with competence vocational. With Thus, the implementation learning in depth on

the Skills Program Agribusiness Plant show characteristics learning integrated vocational knowledge, skills, and attitudes through experience contextual learning.

DISCUSSION

Research result show that implementation learning in depth on the Skills Program Agribusiness Plants at State Vocational School 4 Barru and Islamic Vocational School Pesantren Alam Indonesia were implemented through integration eye lesson productive with Mathematics, Indonesian, and English in learning-based project. The integration No just combine material from a number of eye lessons, but build connectedness draft so that students can connect knowledge academic with practice vocational. Mechanism main supporting implementation This is planning collaborative between teachers who agree objective learning, sharing roles and relationships achievements learning. Productive teachers provide context practice cultivation plants, while the eye teacher lesson general give strengthening draft in accordance need project. Through this process, students utilize draft Mathematics For measurement and data processing, Indonesian for compilation reports and communications results, and English For understand term technical and promotional media produc. Condition This show that learning deep happen because students get experience learning that connects various discipline knowledge in settlement authentic problems, not only Because use learning based project.

Findings This support draft *deep learning* proposed by (Fullan et al., 2020) namely that learning deep allows students to use knowledge for understand situation real and solving problem through a collaborative process. However, research This expand draft the in-context education vocational with show that quality learning deep influenced by the level integration between eyes lessons. Different with a number of studies previously more emphasize effectiveness learning based project on one eye lessons, research This show that collaboration between eye lesson productive and eye lesson general become connecting mechanism competence academic and vocational in One experience learning. Analysis crosses the case also shows that implementation learning at State Vocational School 4 Barru more supported by teacher experience and availability facility practice, while SMKS Islam Pesantren Alam Indonesia develops adaptive strategies through utilization environment learning, setting timetable practice and collaboration between teachers. Differences the show that success learning deep No only determined by completeness facilities and infrastructure, but also by teacher competence, culture collaboration school, and support leadership.

From the aspect student engagement, learning based project give chance to students to involved in planning, implementation practice, discussion group, arrangement reports and presentations results. Involvement the appear Because activity learning own relatedness direct with field learned skills so that students understand benefit every activity to competence vocational that will they use in the workplace. Findings This in line with (Xu et al., 2024) which states that student engagement grows through participation active and interactive collaborative. However, research This show that involvement is also influenced by the quality collaboration between teachers in designing experience integrated learning various eye lesson. Research this also found that teacher readiness in carry out learning integrated Not yet fully evenly. Some teachers have capable designing learning collaborative in a way systematic, whereas part other Still need strengthening in compilation joint teaching and assessment modules cross eye lessons. Findings This indicates that development professional teachers are prerequisite important for sustainability implementation learning deep.

Interpretation to student involvement in study This need understood in accordance characteristics study qualitative findings based on the results observation, interviews, and documentation so that describe experience and perception informant, not measurement quantitative to improvement competence before and after learning. Therefore that, the result study No intended for generalize improvement ability think critical thinking, communication, collaboration, creativity, and independence, but show existence indication development competence the based on the data obtained. In addition, researchers as instrument main as well as use purposive sampling technique has potential give rise to interpretation bias and selection bias informant although has attempted data triangulation and *member checking*. In theoretical, research This strengthen understanding that implementation learning in -depth education vocational is results interaction between teacher competence, collaboration cross eye lessons, support leadership schools, and utilization source Power learning. In a way practical, school need develop collaborative teaching modules, compiling distribution the role of teachers in project, develop assessment cross eye lessons, as well as optimize utilization source available power for implementation learning deep can implemented in a way sustainable in various condition school.

CONCLUSION

Study This show that implementation learning in depth on the Skills Program Agribusiness Plants at State Vocational School 4 Barru and Islamic Vocational School Pesantren Alam Indonesia were carried out through collaboration cross eye lesson between eye lesson productive with Mathematics, Indonesian, and English in learning based project planning learning done through compilation objectives, activities, and assessments in a way collaborative, whereas implementation realized through activity practice, processing information, compilation reports and presentations results project. Activities the give room for students to involved in a way active in the learning process and indicated support development ability think critical, communication, collaboration, creativity, and independence.

Sustainability implementation learning deep influenced by several factors, namely teacher competence, communication and collaboration inter- teacher support head school, student motivation, and utilization environment Study as source learning. On the other hand, research This find obstacle in the form of limitations facilities and infrastructure practice, management time learning based projects, and differences teacher readiness in develop learning integrated. In context study this, learning deep interpreted as a learning process that helps students connect knowledge academic with experience practice in a way authentic and contextual. Findings study limited to two schools that are location research and not intended for generalized in a way extensive research furthermore can done through multi-site studies, longitudinal observations, or approach method mixture For get greater understanding deep about implementation learning depth and development student competencies.

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BS contributes in conceptualization research, preparation instrument research, data collection, data analysis and interpretation, compilation draft beginning manuscripts, as well as revision script. JJ contributed in design methodology, supervision research, validation results research, review critical to substance scientific manuscripts, as well as improvement manuscript. MR contributed in supervision research, validation data analysis and results research, review critical manuscript, editing script, as well as agreement end to version manuscript to be published. All writer has read, agree, and be responsible answer on content end manuscript.

AI DISCLOSURE STATEMENT

The author compiled the entire contents of this manuscript independently, from problem formulation and research implementation, data analysis and interpretation, to the preparation of research results and drawing conclusions. In the

process of refining the manuscript, the author made limited use of ChatGPT as an aid for language editing, grammar correction, increasing the clarity of academic writing, and adjusting the article format in accordance with guidelines. All suggestions or outputs generated through the assistance of artificial intelligence have been critically reviewed, verified, and re-edited by the author. Therefore, the entire scientific substance, data accuracy, interpretation, and content of the article are entirely the responsibility of the author.

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