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Determination of E-LKPD Etnosains on Process Skills: Literacy and Independence Mediation

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Abstract
Students' science process skills are still less than optimal because learning tends to be monotonous and oriented towards the final result. This study aims to analyze the determination of project-based E-LKPD with ethnoscience on students' science process skills and to examine the mediating role of digital literacy and learning independence. The approach used is descriptive quantitative. The study population was all students of SMA Negeri 2 Padang Sidimpuan (approximately 35 people), with a sample of 12 students taken using a purposive sampling technique. Data collection was carried out through a process skills questionnaire after learning using project-based E-LKPD integrated with local wisdom. Data analysis used descriptive analysis by calculating the average, percentage, and standard deviation. The results showed that the project-based E-LKPD with ethnoscience obtained an effectiveness percentage of 90.83% (very good category). All aspects assessed, including ease of use (92.7%), relevance of local wisdom (93.3%), observation skills (85.6%), asking and formulating problems (86.7%), designing and conducting projects (90.0%), analyzing and concluding (89.4%), communicating (93.9%), and overall effectiveness (92.1%) were in the very good category. Thus, the E-LKPD ethnoscience was proven effective in improving students' science process skills, with digital literacy and learning independence acting as mediating variables.

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1. Introduction

Science education in the 21st century is demanding participant educate For No just understand concept, but also capable apply skills scientific in a way active and contextual. One of the fundamental competencies that are needed developed in science learning is science process skills, namely ability observe, formulate problem, hypothesize, design experiments, analyzing data, and drawing conclusions conclusion. Science process skills students who are still Not yet maximum due to the large number of monotonous and only learning develop a number of skills, so that more prioritize results end compared to with the process (R.Dari *et al*., 2025) [15]. Conditions This demand existence innovation teaching materials that are capable push involvement active participant educate in a meaningful learning process.

One of relevant efforts in respond challenge the is Electronic Worksheet Development Student (E-LKPD) based project. With existence development technology information and communication, LKPD with print media forms start develop become a digital LKPD or electronic LKPD that can used through digital devices (Ambarwati *et al*., 2021) [4]. The Independent Curriculum aims adapt learning with need participant educate to be more optimal in understand concept and strengthen competencies, such as skills think critical through literacy science (Agustina & Dhara, 2025) [2]. E-LKPD designed based project allows participant educate for involved in activity investigation real, solve problem authentic, and build knowledge in a way collaborative and independent approach based project is method constructed teaching based on principles constructivism, where students acquire experience learn more interesting as well as meaningful (Zekri *et al*., 2020) [19].

However, for learning science become more contextual and closer with life real participant educate, integration wisdom local through approach ethnoscience become very relevant. Learning ethnoscience teach knowledge the knowledge contained therein contained wisdom local in society ; learning about culture local can increase ability think critical student (Pristiwanti *et al*., 2024; Tressyalina *et al*., 2023) [14, 18].

Ethnoscience is connecting approach science original community (indigenous science) with science scientific science, so that participant educate can integrate values culture local to in understanding scientific they. Development of LKPD based on ethnoscience proven worthy used as means help train science process skills students, with score validation that achieved an excellent average percentage. Some studies previously support effectiveness integration learning based project with ethnoscience. Rahayu shows that Online Project Based Learning based ethnoscience proven effective to science process skills student during pandemic (Oktavianingtyas *et al*., 2018) [13]. In addition, it proves that integration learning based ethnoscience using an influential Project Based Learning model significant to science process skills students. Findings This give runway strong that combination of E-LKPD based project with ethnoscience own potential big in increase quality science learning (Agustina & Dhara, 2025; Pristiwanti *et al*., 2024) [2, 14].

On the other hand, there are two variables that are suspected own role mediation important in connection between E-LKPD based project ethnoscience with science process skills, namely digital literacy and independence Study students. Digital literacy is ability for access, evaluate, and communicate information through device digital technology in critical and ethical. Digital literacy helps student get information, change attitudes, and develop skills with method learn better, fast, fun, and challenging ; even digital literacy today No Again just choice, but rather need important in the modern learning process. More furthermore, digital literacy can make the learning process more effective, expanding insight and knowledge, as well grow independence student in Study (Khasanah & Yushita, 2023; Riyadi *et al*., 2025) [10, 16]. Independence Study as variables mediation second play a role in push participant educate for arrange self alone, determine objectives, choosing learning strategies, and evaluating results study in a way autonomous. Digital literacy and motivation Study in a way positive influential significant to independence Study students, and digital literacy in general positive influential significant to independence learning reinforced by moderation motivation Study. The times are demanding student own ability literacy science and independence learning that can obtained through learning at school. With Thus, digital literacy and independence Study estimated become a mediating bridge influence use of E-LKPD based on project ethnoscience to science process skills student (Aguirre-Mendez & Chen, 2022) [1].

Although various study has reviewing E-LKPD, learning based ethnoscience, digital literacy, and independence Study in a way separate, not yet Lots a study that examines in a way integrative how E-LKPD is based project with ethnoscience can influence science process skills through role mediation digital literacy and independence Study in a way simultaneously. Gap study this is what drives study This conducted. Research This aim for analyze E-LKPD -based determination project with ethnoscience to science process skills students, as well as test role mediation digital literacy and independence Study student in connection The results of the research expected can give contribution theoretical and practical for development innovative teaching materials rooted in wisdom local and responsive to need learning 21st century.

2. Method

Study This use approach quantitative with type descriptive quantitative purposeful For measure effectiveness of e-LKPD based on integrated projects with wisdom local to student process skills. Population in study This is all over students of State Senior High School 2 Padangsidimpuan totaling around 35 people, while samples taken as many as 12 students with use purposive sampling technique. Purposive sampling technique was chosen Because researchers need a true sample follow learning using e-LKPD based project integrated wisdom local, have level minimum attendance of 75%, and willing fill in questionnaire research. Variables in study This consists of on variables free that is effectiveness of e-LKPD based on project integrated wisdom local and variable bound that is student process skills.

2.1. Problem formulation

Formulation problems in research This to what extent is E-LKPD based project with ethnoscience to science process skills students, as well as test role mediation digital literacy and independence Study student.

3. Literature search

Table 1: Research Results Previously about the role of e-LKPD in Learning

No	Year	Researchers	Article Title	Results Found
1	2021	Suryaningsih, S. & Nurlita, R.	The Importance of Worksheets Innovative Electronic Student Worksheet (E-LKPD) in the 21st Century Learning Process	Innovative e-LKPD proven capable increase activeness and motivation Study students. E-LKPD is assessed more attractive, flexible, and interactive compared to conventional LKPD, as well as support skills 21st century like think critical thinking, collaboration, and digital literacy.
2	2021	Laily Eka Prastiwi & Yuliani	Development of E-LKPD Based on Science Literacy for Train Skills Students' Critical Thinking on Growth and Development Material	E-LKPD based literacy science declared valid, practical and effective For train skills think critical participant high school education. Development using 4D models and generating worthy product based on assessment of expert validators and biology teachers.
3	2022	Masruhah, R., Zaini, M. & Kaspul, K.	The Influence of Electronic Motion System Student Worksheets on Students' Learning Outcomes and Critical Thinking Skills	Use of the E-LKPD system movement in a way significant increase results Study cognitive and skills think critical participant high school students compared learning conventional. Significant differences found between class experiments and classes control.
4	2022	Wahono, RHJ, Supeno, S. & Sutomo, M.	Development of E-LKPD with Approach Scientific For Increase Skills Critical Thinking of Elementary School Students in Science Learning	E-LKPD with approach scientific proven effective increase skills think critical elementary school students in Science learning. Validity and practicality product reach very good category based on validator assessment and response student.
5	2023	Hasanah, I. & Wisanti, W.	Development of E-LKPD Based on Problem Based Learning for Practice Skills Critical Thinking on Plant Growth and Development	-based E-LKPD on the material growth and development plant worthy used and effective practice skills think critical student Grade XII of high school. Product fulfil criteria required validity, practicality, and effectiveness.
6	2023	Nurfitriani, WY, Sjaifuddin & Vitasari, M.	Development of E-LKPD Based on Guided Discovery Learning with Approach Science Process Skills on the Theme of Substances Contained in My Food	E-LKPD based on Guided Discovery Learning with the KPS approach was successful developed with level very high validity from expert validators. Products assessed worthy and capable facilitate science process skills student in a way effective in thematic science learning.
7	2024	Musdalifah, M., Lumowa, SVT & Rambitan, VMM	Development of Canva-Based Electronic Student Worksheet (E-LKPD) to Improve Student Biology Learning Outcomes	Canva -based e-LKPD is proven to be valid and effective increase results Study biology high school students. Attractive visual display and ease of use digital access contributes to increasing motivation and engagement Study participant educate in a way significant.
8	2024	Pratiwi, P.	Development of Interactive E-LKPD Project Based Learning Based Scientific Literacy in Science Learning	Interactive e-LKPD PjBL based literacy science feasible and effectively used in science learning. Products capable increase ability literacy science and encourage involvement active student through activity authentic and contextual projects.
9	2024	Rukmana, RD & Fitrihidajati, H.	Validity and Practicality of Interactive E-LKPD Project Based Learning Oriented on Change Material Environment For Train Skills Critical thinking	Interactive e-LKPD based PjBL on material change environment declared valid and practical For train skills think critical student Grade X SMA. Validity assessed by experts' materials and media, whereas practicality shown from implementation learning and response positive student.
10	2025	Rosanti, NP & Bashri, A.	Development of Interactive E-LKPD Based on the 5E Learning Cycle Model on the Reproduction Sub-Material Plant For Train Ability Digital Literacy	Interactive e-LKPD based on the 5E Learning Cycle successfully developed and proven effective train ability digital literacy of high school students. Participation active student in use digital features in E-LKPD encourage improvement ability digital literacy in general measurable.

3.1. Data evaluation

Data collection was carried out through three stage. Stage preparation covering compilation grid and grains questionnaire, trial instruments, as well as revision If required. Stage implementation that is give learning using e-LKPD based project integrated wisdom local to 12 samples, then after learning finished student requested fill in questionnaire process skills. Stage end covering collection questionnaires and examinations completeness of data

3.2. Data analysis and interpretation

Analysis of the data used is analysis descriptive with calculate the average per student, average per indicator process skills, standards deviation, minimum and maximum scores, and percentage achievement use formula scores obtained shared score ideal maximum multiplied by 100 percent. Next, the percentage the categorized to in criteria effectiveness, namely very effective If reached 80 percent to above, effective if 60 to 79 percent, enough effective if 40 to 59 percent, less effective if 20 to 39 percent, and very less effective if it is below 20 percent. Research This held at State Senior High School 2 Padangsidimpuan with notice ethics research, such as request permission official to head school, get agreement from student as respondents, maintain data confidentiality, and using initials in data presentation.

4. Results and Discussion

4.1. Results

Table 2: Summary of Likert Scale Analysis Results per Aspect

No.	Aspect	Item	Total Score	Average	Percentage (%)
A	Convenience Use of e-LKPD	1–5	278	4.63	92.7 % (Very Good)
B	Relevance of Local Wisdom	6–10	280	4.67	93.3 % (Very Good)
C	Skills Observing	11–13	154	4.28	85.6 % (Very Good)
D	Skills Asking & Formulating Problem	14–16	156	4.33	86.7 % (Very Good)
E	Skills Design & Execute Project	17–20	216	4.50	90.0 % (Very Good)
F	Skills Analyze & Conclude	21–23	161	4.47	89.4 % (Very Good)
G	Skills Communicating	24–26	169	4.69	93.9 % (Very Good)
H	Effectiveness The entire e-LKPD	27–30	221	4.60	92.1 % (Very Good)
Total	Overall	1–30	1,635	4.54	90.83 % (Very Good)

Based on the table above, all aspects evaluated in study This is in the range of 85.6%–93.9%, all of which including in Very Good category. None aspects that are below Very Good category. Even distribution across categories highest This indicates that e-LKPD is based on project wisdom locally developed own consistent quality across all measured dimensions. Can see from the graph below This :

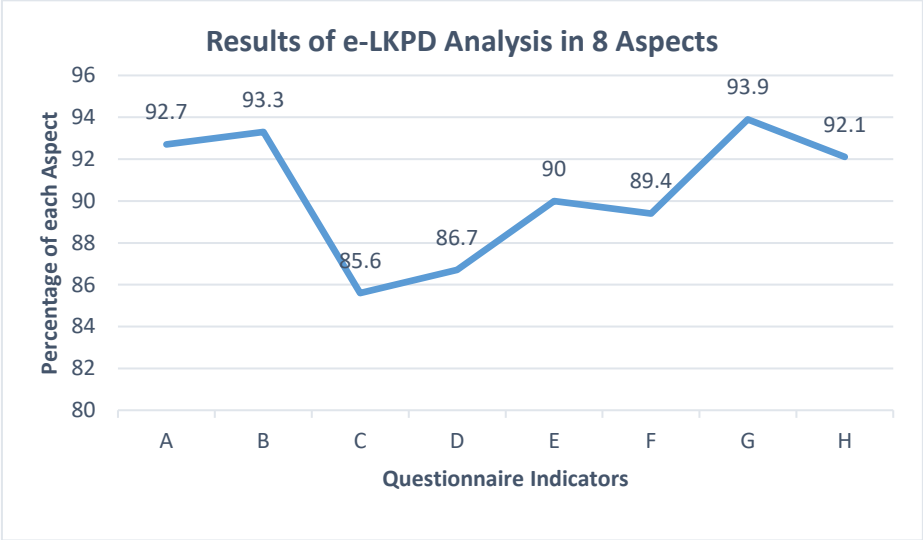

Fig 1: Graph Percentage LKPD Analysis from 8 Aspects

5. Discussion

5.1. Convenience Use of e-LKPD (Aspect A)

Based on results questionnaire data analysis, aspects convenience the use of e-LKPD obtained a total score amounting to 278 of score maximum 300, with percentage 92.7% of which is included in category Very Good. Average score per item on the aspect This reached 4.63 of scale 5. This result reflect that display, navigation, instructions usage, as well as legibility content in e-LKPD is considered very good by all respondents. Findings This in line with research conducted by Modanggu (2024) [23] regarding response participant educate towards the Liveworksheets web- based E-LKPD, which shows that aspect convenience use get average score of 87. 4% with very good category. Research the confirm that design interactive and flexible interface in use of e- LKPD significant contribute to convenience Study student.

In addition, Rosdianah *et al*. (2024) [25] in development of electronic LKPD based Liveworksheet on the material Ecosystem in Elementary School reports that level the practicality of e-LKPD gets an average percentage 98.33 % of incoming in very practical category. This is strengthen findings that the electronic format of the LKPD makes it easier student in access and interact with material learning show that questionnaire response student towards E-LKPD based on Canva Site reached 90% with very practical category, which is consistent support results study This.

Convenience high use of e-LKPD in research This can associated with design that considers characteristics users. According to Ambarwati *et al*. (2021) [4], innovation education based digital technology that pays attention aspect convenience access and attractiveness appearance proven increase efficiency of the learning process. With Thus, e-LKPD is based on integrated projects with wisdom local in study This has fulfil standard convenience required use For support activity effective learning.

5.2. The Relevance of Local Wisdom in Learning (Aspect B)

Aspect relevance wisdom local get percentage highest second, namely 93.3% with a total score of 280 and an average per item of 4.67. This shows that students really feel relatedness between element wisdom local served in e-LKPD with life daily they, as well as feel proud Because culture area they integrated to in the learning process. This result in harmony with study Musyarrofah *et al*. (2024) [24] shows that students involved in learning based wisdom local show level more involvement high, understanding more concepts

good.and attitude positive to learning. Research the use method quasi-experimental and finding improvement significant motivation study in groups experiments that get learning based wisdom local compared to group control.
According to (Mahyudin & Hasan, 2025) [11] integration wisdom local North Maluku in learning thermodynamics conclude that student give response positive to learning based wisdom local Because assessed more meaningful, easy understood, and increase motivation and engagement learning. Context familiar culture make material science felt more relevant for learners. Sari (2022) [26] as quoted in various study, stated that learning that relates material lesson with culture and experience student Alone make student more interested and feel own connection emotional with material said, so that increase greater involvement and understanding in- depth findings This reinforced by research learning thematic based ethnoscience that proves existence improvement significant in understanding draft science at a time increasing appreciation to wisdom local. Therefore, that is, the percentage of 93.3% achieved in study This show success integration wisdom local in create learning contextual and meaningful science for student.

5.3. Skills Observing (Aspect C)

Aspect skills observe get percentage as big as 85.6% with a total score of 154 and an average per item of 4.28. Although percentage This is the lowest among all over aspects, values This still enter in Very Good category and is above threshold of 81%. Skills observe is foundation from science process skills. According to Rustaman science process skills covers ability communicate, predict, attract conclusions, interpreting data, defining in a way operational, making hypothesis, control variables, designing experiment, and do experiments, all of which rooted in ability good observation.
Study Ikebayu *et al*. (2025) [8] who applied the PjBL model with multimedia on elementary school students reporting that science process skills student increase from 74.66% in cycle I to 83.19% in cycle II and reaching 90.01% in cycle III. The pattern of increase This show that skills observing the beginning not yet optimal improved in a way gradually through learning based structured project. This is relevant with study this, where the achievement is 85.6% in this aspect observe reflect stage very good start from development student process skills. Haryono (2006) [6] emphasized that development science process skills will develop competence base student like ability solution problem, so that can form student become creative and innovative. In e-LKPD context based project wisdom local this activity linked observations with phenomenon culture local provide rich stimulus for senses student so that support development skills observation they.

5.4. Skills Asking and Formulating Problem (Aspect D)

Aspect skills ask and formulate problem get percentage 86.7% with a total score of 156 and an average of 4.33. This result show that e-LKPD was successful push student For submit questions, formulate hypothesis, and stimulate curiosity know they to material lesson. Ability formulate problem is skills level height is important in science. Research Improvement Science Process Skills of Junior High School Students through the Problem Based Learning Model (2023) confirms that science process skills involving ability For observe, predict, classify, do experiments, analyzing data, and communicating. Skills This No only play a role in understand and apply concepts science, but also in develop thinking critical, creativity, and problem-solving problem.
Study it also highlights that method too much learning focused on giving information and regular training often No adequate in help student control skills This in a way deep. This is strengthening importance use of e-LKPD based on projects that provide room for student for ask and formulate problem in a way active, as reflected in the percentage of 86.7% achieved in the study This. More further findings Yuniasih (2022) as quoted in study Journal Education Window (2025) shows that the Project Based Learning model encourages student develop ability think critical and curious know under investigation scientific. Context integration wisdom local in e-LKPD in research This give material contextual and relevant questions, so that stimulate student For more active in formulate problem.

5.5. Skills Designing and Executing Project (Aspect E)

Aspect skills design and carry out project get percentage 90.0% with a total score of 216 and an average of 4.50. This result reflect that e-LKPD is based on project succeed guide student in understand steps design project, implement it in accordance procedures, and work in a way systematic. Findings This supported by the results of a systematic review conducted by Laila et.al on 25 articles journal about PjBL in published science learning between 2018-2025. The review conclude that PjBL in a way consistent increase results Study cognitive skills think critical, literacy science, motivation, and ability collaborative students (Laila *et al*., 2025) [21]. Learning based contextual projects also encourage involvement active and responsible answer student towards the learning process.
Development of E-LKPD based on wisdom local craft woven bamboo Project Based Learning model also get N-gain value against understanding draft student with an average of 0.82 criteria high, which indicates significant effectiveness in increase competence student through project based wisdom local. This is consistent with 90% percentage achieved in the aspect design and carry out project in study This. The effectiveness of the Project Based Learning model on science process skills and abilities think creative student find significant difference between classes that implement PjBL with class control that uses learning conventional (Chasanah, 2015) [20]. PjBL Model proven capable develop skills design and implement test in a way structured, parallel with findings in study This.

5.6. Skills Analyzing and Concluding (Aspect F)

Aspect skills analyze and conclude get percentage 89.4% with a total score of 161 and an average of 4.47. This result show that e-LKPD is effective practice student For analyze the results data project, interesting conclusion based on facts, and thinking critical to results activities. Skills analyze and conclude is component essential from High science process skills. Development of Learning Modules Based PjBL For Increase science process skills and thinking critical students (2025) reported that module based PjBL own level validity tall with score 4.4 (very good category), and effective in develop ability analysis and thinking critical students. Findings This in harmony with percentage of 89.4% obtained in the aspect This.
Process skills can give improvement motivation and achievement Study student (Muttaqin & Rizkiyah, 2022) [12]. Development skills analysis in context project-based wisdom

local give dimensions addition Because student No only analyzing science data, but also connecting them with knowledge local area that is familiar to they. This process strengthens understanding conceptual at a time grow appreciation to values culture.

5.7. Skills Communicating (Aspect G)

Aspect skills communicate get percentage the highest among all over aspects, namely 93.9% with a total score of 169 and an average of 4.69. This indicates that e-LKPD is based on very effective project in practice student serve results project in a way oral and writing, discussing and presenting results work. The height percentage on aspects communicate in line with characteristics of the PjBL model which are inherent push activity presentation and collaboration. Research by Dharma S. and Waras Kamdi (in Journal Education Window, 2025) states that Project Based Learning can push student in develop ability communicate, give experience direct in organize sources and equipment For settlement tasks, as well as implement knowledge and information to in life real. The obstacles found in implementation PjBL is student difficulty share time and not yet used to convey results project. However, in study this aspect communicate precisely get mark highest, which indicates that the e-LKPD that was developed succeed provide adequate scaffolding for student in serve results Work they.
This can also be associated with context wisdom local that makes student more believe self and enthusiasm in communicate results project they, because topics discussed is part from experience the culture they know. Astuti emphasized that integration wisdom local in learning science capable increase literacy science students, including ability communicate knowledge science in context life real (Mahyudin & Hasan, 2025) [11]

5.8. Effectiveness Overall e-LKPD (Aspect H)

Aspect effectiveness the entire e-LKPD obtained percentage 92.1% with a total score of 221 and an average of 4.60. Students in a way overall evaluate that e-LKPD is based on integrated projects with wisdom local effective in increase their process skills, making they more active in learning, and helping they understand material in a way in- depth findings This supported by various study previously. E-LKPD research based on wisdom local batik motifs from Serang City that developed e-LKPD liveworksheet based wisdom local report results questionnaire response student 90.34 % is classified as category very good. Research it also noted improvement ability think critical student with an N-Gain of 0.56 (Pristiwanti *et al*., 2024) [14]. Very similar response rates with study This show consistency findings that e-LKPD is based on wisdom local accepted very well by students.
In study design build E-LKPD model PBL material water cycle report that practicality test results based on questionnaire response student get percentage of 80% and questionnaire teacher response of 90% with very good category or very practical (Aimanah *et al*., 2026) [3]. Temporary that, E-LKPD research is based on ethnopedagogy for train literacy science student show mark 98.6% validation with implementation learning reached 95.8%, which confirmed the effectiveness of the e-LKPD format in support learning quality science.
Research conducted by (Zekri *et al*., 2020) [19] about influence learning-based project in learning chemistry to science process skills reviewed from style cognitive students also support findings this, where learning based project proven increase science process skills in a way significant. From the perspective this, a gain of 92.1% in this aspect effectiveness overall in study This is confirmation strong empirical on effectiveness of e-LKPD based on project wisdom locally developed.

5.9. The effectiveness of e-LKPD in general Overall

In a way overall, results analysis questionnaire against 12 respondents with 30 statement items show that e-LKPD is based on Integrated Projects with Local Wisdom gets a total score 1,635 out of 1,800 (score ideal maximum), produces percentage as big as 90.83% of which is included in category Very Good. Nothing none of the respondents gave answers on a scale of 1, 2, or 3, and all respondents be in range score 131-147 out of a total of 150, which shows consistency evaluation positive. This result beyond the threshold of the very good category (81%) and is at an equivalent level even beyond various study relevant past. As comparison, research of web- based E-LKPD Liveworksheets (Scholes *et al*., 2021) [17] obtained an average assessment of 87.1%; E-LKPD based literacy science obtained 86.41%; and E-LKPD based on wisdom local batik motifs obtained 90.34% (Pristiwanti *et al*., 2024) [14]. The percentage of 90.83% in study This is above average in various study similar, which confirms the quality of the e-LKPD developed.
In a way theoretical, success This can explained through principle learning contextually put forward by various expert. Meaningful learning happen when material studied connected with experience and context culture students. Integration of wisdom local in e-LKPD based project create bridge between knowledge scientific with life daily students, so that learning No only effective in a way cognitive but also meaningful in a way cultural.

6. Conclusion

Based on results research and discussion that has been described, can concluded that E-LKPD is based on integrated projects with ethnoscience or wisdom local proven effective in increase science process skills students. This is shown by the acquisition percentage effectiveness in a way overall amounting to 90.83% which includes in very good category. All aspect science process skills that are measured include skills observing (85.6%), skills ask and formulate problems (86.7%), skills design and carry out projects (90.0%), skills analyzing and concluding (89.4%), as well as skills communicate (93.9%), all is in the very good category. Aspect convenience use of E-LKPD to obtain percentage of 92.7% and aspects relevance wisdom local reached 93.3%, which indicates that interactive E-LKPD design as well as integration culture local nearby with life student capable make learning become more contextual, meaningful, and capable push involvement active participant educate. In addition, digital literacy and independence Study play a role as variables strengthening mediation the influence of E-LKPD ethnoscience to science process skills, although testing statistics more carry on Still required for confirm magnitude influence mediation said. With Thus, E-LKPD is based on project integrated wisdom local worthy recommended as responsive innovative teaching materials to need learning 21st century at once preserve values culture local in education science.

7. Thank You Note

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