Development and Validation of an Assessment Tool for Science Lesson Plans

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ABSTRACT

Effective lesson planning is a critical yet frequently under-assessed component of high-quality science instruction. Despite its importance, existing tools for evaluating science lesson plans often lack specificity, consistency, and empirical validation. This study addresses this gap by developing and validating the Lesson Plan Assessment Tool for Science (LPATS), a standardized instrument designed to assess the quality of science lesson plans and teachers' competence in lesson planning. Grounded in established pedagogical frameworks and informed by gaps identified in the literature, the study employed a developmental research design comprising four phases: initial tool construction, expert review, iterative refinement, and validation. Qualitative input from science education experts guided the revision of indicator statements to ensure clarity, coherence, and alignment with curricular and instructional standards. Quantitative analysis of content validity, using the item-level content validity index (I-CVI), scale-level content validity index (S-CVI), and modified kappa statistics, yielded perfect agreement scores (1.00), indicating strong expert consensus regarding the tool's relevance and clarity. These results confirm LPATS as a valid and practical instrument for evaluating science lesson plans in both pre-service and in-service teacher education contexts. Beyond assessment, the tool supports reflective teaching practice, curriculum evaluation, and instructional quality assurance. LPATS offers a research-informed, user-friendly framework that advances science education by addressing the methodological need for a discipline-specific lesson plan evaluation tool. Future studies should investigate its construct validity, inter-rater reliability, and applicability across broader educational settings and long-term impact.

Keywords: Lesson plan assessment; science education; teacher competence; instrument validation; instructional quality

INTRODUCTION

Effective lesson planning is widely recognized as a foundational component of high-quality teaching and learning. In science education, well-structured lesson plans are essential for designing instructional strategies that foster conceptual understanding, address common student misconceptions, and incorporate both formative and summative assessments. As Gejdošová and Velmovská (2024) highlight, lesson planning requires teachers to skillfully integrate content knowledge, pedagogical strategies, and assessment practices into coherent and purposeful learning experiences. Designing such lessons necessitates a range of professional competencies that extend beyond content mastery to include pedagogical reasoning, curriculum alignment, and adaptive decision-making.

However, despite the critical role of lesson planning, a persistent problem in science education lies in the lack of standardized tools to assess teachers' competence in designing a lesson. While lesson plans serve as concrete representations of instructional thinking, most current evaluation practices focus on observable teaching performance, often neglecting the planning processes that precede classroom instruction. Tools such as the Classroom Observation Tool (COT) provide general teaching indicators but fall short in capturing the pedagogical decisions embedded in lesson planning.

Over the years, research has sought to improve teaching competence through various approaches, including professional development programs (Khofiya, 2022), collaborative learning environments (Lee, 2020), and professional learning communities (Vathanavong, 2024). Extensive literature also addresses the development of pre-service teacher competencies (Zimmermann et al., 2021; Fabelico & Appala, 2023; Krepf & König, 2023). However, there remains a clear gap: few studies offer validated, output-based tools specifically designed to assess the structure and quality of science lesson plans. This gap highlights the need for a domain-specific, empirically grounded framework that systematically evaluates planning competence as an independent and measurable construct.

To address this gap, this study introduces the Lesson Plan Assessment Tool for Science (LPATS)—a structured, model-agnostic instrument designed to assess science lesson plans across three essential instructional phases: before, during, and after the lesson. LPATS builds is an output-based assessment tool that aligns with the Philippine Department of Education's DepEd Order No. 42, s. 2016, which underscores lesson planning as a key element of instructional

quality in K–12 education. Importantly, the tool accommodates various lesson plan models commonly used in the Philippines, including the 5E, 7E, 4A, and 5A formats, making it adaptable and widely applicable.

Drawing from the literature on pedagogy and lesson planning (Carlson et al., 2019; Kopp et al., 2025; Zaragoza et al., 2021), LPATS incorporates multiple dimensions of planning competence: alignment with curriculum standards, lesson structure coherence, selection of teaching strategies, design of assessments, and responsiveness to diverse learner needs. What sets LPATS apart from existing evaluation frameworks is its explicit focus on assessing the lesson planning competence of both preservice and in-service science teachers through systematic analysis of their lesson plan outputs—an area that remains significantly underexplored in the field of science education.

The primary objectives of this study are threefold: (1) to develop a structured and reliable assessment tool to evaluate science lesson planning competence based on output-based criteria; (2) to establish the content validity of LPATS using qualitative expert feedback and quantitative indices; and (3) to ensure the tool's flexibility and relevance across different instructional models in science education. By doing so, the study offers a practical, evidence-informed solution to evaluating instructional readiness and enhancing teacher competence through systematic lesson plan assessment.

METHOD

This study adopted a developmental research design, which is well-suited for the systematic development, validation, and refinement of educational tools and interventions (Richey & Klein, 2014). The purpose of this research was to develop and validate the Lesson Plan Assessment Tool for Science (LPATS), a standardized instrument intended to assess the lesson planning competence of preservice and in-service science teachers based on output-based indicators. The multi-phase methodology integrated theoretical and empirical inputs to ensure both pedagogical alignment and psychometric soundness.

Instrument Development and Theoretical Foundation

The development of LPATS commenced with a comprehensive review of existing literature and policy frameworks to define the essential components of effective lesson planning. Relevant sources included national curriculum standards (DepEd Order No. 42, s. 2016), teacher education frameworks, and prior empirical studies on science instructional planning (Großmann & Krüger, 2024). These sources guided the identification and formulation of planning

indicators organized into three key instructional phases: pre-lesson, lesson proper, and post-lesson.

The tool integrates critical competencies such as the alignment of SMART objectives with standards, use of interactive pedagogies, integration of formative assessments, anticipation of misconceptions, and responsiveness to learner diversity. The framework was partially adapted from Enama (2021), ensuring relevance to the Philippine K–12 context.

Validation Procedures

A three-step validation process was employed:

1. Expert Review and Qualitative Feedback

The initial LPATS draft was reviewed by three subject matter experts selected through purposive sampling, based on the following criteria: (1) active affiliation with DepEd or a state university, (2) at least 15 years of experience as a cooperating teacher, and (3) doctoral-level qualification or equivalent. Experts provided qualitative feedback on the clarity, relevance, and domain alignment of each indicator. Suggestions were incorporated into a revised version of the tool.

2. Face and Content Validity Assessment

To assess face validity, the experts evaluated whether the instrument's items appeared to measure lesson planning competence appropriately. For content validity, a 4-point Likert scale was used to rate each item's relevance. Ratings of 3 or 4 were recoded as "1" (relevant), while 1 or 2 were coded as "0" (not relevant). Based on these ratings, Item-Level Content Validity Index (I-CVI), Scale-Level Content Validity Index (S-CVI), and modified kappa statistics were computed (Zamanzadeh et al., 2015).

I-CVI: Proportion of experts rating each item as relevant.

S-CVI/Ave: Average of I-CVIs across all items.

S-CVI/UA: Proportion of items receiving unanimous agreement (I-CVI = 1.00).

Modified Kappa: Adjusted for chance agreement, with values ≥0.81 interpreted as "almost perfect agreement" (Polit et al., 2007).

All indicators yielded I-CVI = 1.00, S-CVI/Ave = 1.00, and Kappa = 1.00, indicating strong content validity.

3. Pilot Testing and Usability Analysis

The revised LPATS was pilot-tested by three experienced cooperating teachers who assessed 62 lesson plans developed by preservice science teachers during internship. The pilot was conducted in two rounds. In the first round, 31 lesson plans were rated, followed by evaluator debriefing and minor revisions to the tool. The final version was then used to assess the remaining 31 plans. The cooperating teachers attended an orientation via Google Meet to

standardize tool usage. While formal inter-rater reliability (e.g., Cohen's Kappa or ICC) was not calculated due to the small number of raters, narrative feedback revealed a high level of interpretive consistency and practical usability.

Assessment Criteria and Rating Scale

LPATS indicators are anchored to evidence-based practices and are rated using a three-point ordinal scale:

3 – Highly Competent: Instructional intentions are coherent, complete, and pedagogically sound.

2 – Fairly Competent: Lesson planning reflects a general understanding of competencies but lacks clarity or consistency in at least one domain.

1 – Needs Improvement: Planning is deficient in critical areas; key elements are missing or misaligned.

This scale offers a structured, formative framework for diagnosing planning competence and guiding science teacher improvement.

FINDINGS AND DISCUSSION

The primary outcome of this study is the development and validation of the Lesson Plan Assessment Tool for Science (LPATS)—a rigorously designed instrument intended to evaluate both the quality of science lesson plans and the competence of teachers in lesson planning. The tool encompasses key dimensions of effective science instruction, including the coherence and relevance of content, the appropriateness of instructional strategies—such as the integration of effective questioning to stimulate critical thinking—and the alignment of assessment tasks with real-world application of scientific knowledge and skills.

Following expert panel review and iterative validation procedures, the LPATS underwent several revisions to enhance clarity, eliminate redundancies, and improve construct representation. Notably, one expert emphasized the need to strengthen the tool's capacity to assess lesson quality as a direct reflection of teachers' planning competence. In response, the criteria for evaluating competence were more explicitly defined within the tool's structure, ensuring that domain-specific indicators are clearly articulated and consistently interpreted across evaluators. These refinements contributed to improved accuracy, usability, and alignment with the intended assessment purpose. A summary of the expert validators' comments and suggestions is presented in Table 1.

Table 1:
Summary of Pre-validator Comments and Suggestions of LPATS

Statement	Comments /Suggestions	Action taken and Revisions
1) Prior knowledge is elicited.	Please specify the details of this item.	To address the suggestion, the item was revised to be more specific by highlighting how prior knowledge should be connected to students' real-life experiences or accessed through effective pre-assessment strategies.
2) The lesson has at least two (2) SMART outcomes.	Highly relevant and clear. No changes needed.	No revision was made since the item was deemed highly relevant and clear. It was retained in its original form.
3) Get the student's thinking and attention when the lesson is introduced.	Could you provide more specific details about this item to clarify it further?	The item was clarified to describe specific strategies for engaging students at the beginning of the lesson, such as raising questions, stimulating thinking, and preparing them for learning.
4) Connect the new lesson with what the learner already knows.	Make it more detailed	To address the feedback for more detail, the item was revised to emphasize the use of demonstrations, illustrations, or models in presenting new content, ensuring continuity with prior knowledge.
5) State the new lesson's objective as a guide for the learners.	You may revise or change the item. Consider some of my recommendations.	This item was modified to better reflect formative assessment practices. It now emphasizes checking for learners' understanding as a way to align lesson objectives with student learning progress.
6) The lesson conveys new information to the learners through demonstration, illustration, or explanation of a model, concepts, skills, etc.	Highly relevant and clear. No changes needed.	The item was found to be clear and relevant and was therefore retained without any changes.
7) The lesson regularly checks for the learners' understanding.	Implement formative assessment techniques to monitor student understanding	The comment regarding formative assessment was addressed by refining the statement to explicitly mention the use of formative assessment techniques to monitor student understanding.
8) The activity is creative, suitable for the topic and aligns with the learning outcomes and objectives.	Highly relevant and clear. No changes needed.	This item was considered effective and aligned with expectations, so it was retained without any changes.
9) The activity is effective for activating background knowledge	Maybe you can revise the item particularly on the term "effective"	Based on the suggestion, the term "effective" was considered, and item 10 was integrated here to make the item more comprehensive. The revised statement reflects the activity's appropriateness for the type of learner.

10) The activity is suitable for this type of learner.	Maybe you can fuse no. 9 and 10	This item was fused with item 9 to avoid redundancy. It was not retained as a separate entry but its content was integrated into item 9.
11) The instructional strategy is systematic, reinforcing, and aligned with the learning outcomes.	Make the statement more specific	To make this item more specific, suggested classroom practices such as group discussions, mind mapping, and listing pros and cons were included in the revised version.
12) It asks relevant questions to guide students' thinking, and the teacher candidate provides the expected answer to the question.	You may also integrate this during the lesson proper	Following the suggestion, this item was integrated into item 11 to ensure that questioning strategies are part of the instructional approach during lesson delivery.
13) The assessment activity aligns with the learning outcomes.	Reflect on the effectiveness of the lesson in achieving objectives.	In response to the suggestion to reflect on lesson effectiveness, the item was revised to highlight how assessment results can demonstrate achievement of objectives. It was also re-ordered in the list for better organization.
14) The assessment focuses on using and applying knowledge and skills in real-life situations.	Highly relevant and clear. No changes needed.	This item was retained without revision, as it was considered clear and relevant. It was simply renumbered to maintain logical sequence.
15) The take-home assignment helps consolidate students' new knowledge.	Redundant with item number 16	This item was removed due to redundancy with the subsequent item, which more clearly emphasizes the real-life application of the assignment.
16) The take-home assignment reflects and relates real-life situations.	Highly relevant and clear. No changes needed.	This item was retained and moved up in the sequence to replace the removed item, ensuring clarity and relevance in the final structure.
17) The lesson plan clearly provides a summary or wrap-up activity to showcase students' learning	Highly relevant and clear. No changes needed.	The item was retained without revision, as it was seen as clear and necessary. It was renumbered for consistency.

The pre-validation phase provided critical insights into the clarity, relevance, and structural coherence of the Lesson Plan Assessment Tool for Science (LPATS). Expert feedback informed targeted revisions aimed at

strengthening the specificity, internal consistency, and pedagogical alignment of the assessment criteria.

Several items (e.g., Items 2, 6, 8, 14, 16, and 17) were identified as clearly articulated and pedagogically sound, and were therefore retained without modification. In contrast, other items required revision to enhance clarity, better reflect evidence-based instructional practices, and ensure alignment with key dimensions of effective science lesson planning.

Notable revisions included:

- **Item 1** was refined to emphasize both elicitation of prior knowledge and its meaningful connection to learners' real-life experiences. The original statement, *"Prior knowledge is elicited,"* was revised to: *"Prior knowledge is elicited in a way that allows students to connect it to their real-life experiences."*
- **Item 3** was revised to ensure that the lesson introduction actively engages learners by fostering curiosity and reflective thinking.
- **Item 5** was substantially modified to focus on the use of formative assessment strategies for monitoring student understanding, rather than merely stating lesson objectives.
- **Items 9 and 10** were consolidated to reduce redundancy, resulting in a more streamlined criterion addressing both the activation of background knowledge and responsiveness to learners' needs.
- **Item 15** was removed due to its conceptual overlap with Item 16, improving the overall conciseness of the instrument.
- **Items 12, 14, 15, and 16** were reorganized to enhance logical sequencing and improve the internal coherence of the tool.

These iterative refinements addressed ambiguities, improved item clarity, and reinforced alignment with current principles of lesson planning in science education. Collectively, the changes contributed to stronger content validity, enhanced usability, and greater accuracy in assessing preservice teachers' lesson planning competence.

To quantitatively support expert feedback, the Content Validity Index (CVI) was computed for each item. Following the recommendations of Polit and Beck (2006), content validity is a prerequisite for reliability; an instrument that fails to adequately represent the construct it intends to measure may yield unreliable results. Accordingly, item-level CVIs were calculated based on validators' ratings of relevance, with decisions to revise, retain, or remove each item informed by these indices. Table 2 presents the computed CVIs alongside the corresponding decisions made during the pre-validation process.

Table 2:
Content Validity Index LPATS (Pre-validation)

item	Rater 1	Rater 2	Rater 3	No. in agreement	Experts	ICVI	Pc	Kappa	Interpretation	Decision
1	1	1	0	2	3	0.67	0.375	0.467	fair	Revise
2	1	1	0	2	3	0.67	0.375	0.467	fair	Revise
3	1	0	1	2	3	0.67	0.375	0.467	fair	Revise
4	1	1	1	3	3	1.00	0.125	1.000	Excellent	Retain
5	1	1	1	3	3	1.00	0.125	1.000	Excellent	Retain
6	1	1	1	3	3	1.00	0.125	1.000	Excellent	Retain
7	1	1	1	3	3	1.00	0.125	1.000	Excellent	Retain
8	1	1	1	3	3	1.00	0.125	1.000	Excellent	Retain
9	1	0	1	2	3	0.67	0.375	0.467	fair	Revise
10	1	1	1	3	3	1.00	0.125	1.000	Excellent	Retain
11	1	0	0	1	3	0.33	0.375	-0.067	poor	Remove
12	1	1	1	3	3	1.00	0.125	1.000	Excellent	Retain
13	1	1	0	2	3	0.67	0.375	0.467	Fair	Revise
14	1	1	1	3	3	1.00	0.125	1.000	Excellent	Retain
15	1	0	0	1	3	0.33	0.375	-0.067	poor	Remove
16	1	1	1	3	3	1.00	0.125	1.000	Excellent	Retain
17	1	1	1	3	3	1.00	0.125	1.000	Excellent	Retain

Table 2 presents the pre-validation results of the Lesson Plan Analysis Tool for Science (LPATS) revealing variations in the content validity of individual items, as assessed by expert raters. Items with an Item Content Validity Index (ICVI) of 1.00 and a Kappa value (κ) of 1.00 indicate excellent agreement among experts, confirming their strong relevance to the construct being measured. These items (4, 5, 6, 7, 8, 10, 12, 14, 16, and 17) were retained without modification.

Conversely, items with a fair validity rating (ICVI = 0.67, κ = 0.467) suggest moderate agreement among experts. These include Items 1, 2, 3, 9, and 13, which require revisions to enhance clarity, relevance, or alignment with the intended construct.

Items 11 and 15 received poor ratings (ICVI = 0.33, κ = -0.067), indicating low agreement and potential issues with relevance or clarity. Given their weak content validity, these items were recommended for removal from the instrument.

Overall, the pre-validation process identified items requiring refinement to improve their alignment with the intended assessment criteria. The feedback from expert raters provided a basis for revisions, ensuring that the final version of LPATS maintains high content validity and effectively evaluates lesson planning competence.

The post-validation process involved a separate group of expert teachers who utilized the instrument to evaluate 31 lesson plans. Following the evaluation, these teachers were provided with a validation form and asked to offer comments and suggestions for further refinement of the instrument. Table 3 summarizes the key feedback and recommendations provided by the validators.

Table 3:
Summary of Post-validator Comments and Suggestions of LPATS

Statement	Comments /Suggestions	Action taken and Revisions
1) Define clear learning objectives that are SMART and aligned with curriculum standards	It might be helpful to spell out what SMART stands for to ensure clarity for all users	The acronym "SMART" was spelled out to improve clarity for all users, especially those unfamiliar with the term
2) Prior knowledge is elicited in a way that students can relate it to their real-life experience. Or an excellent pre-assessment strategy is exhibited to access prior knowledge.	The item is highly relevant, but the wording can be streamlined for clarity. Consider revising	The wording was streamlined for conciseness and clarity while preserving the meaning. The phrase "excellent pre-assessment strategy" was replaced with "effective" for a more objective tone.
3) The lesson engages the learners by getting their attention, raising questions in their minds, stimulating their thinking, or getting them interested and ready to learn.	Highly relevant and clear. No changes needed.	No changes were necessary. The item was retained as is due to its clarity and relevance.
4) Tries to identify common student misconceptions related to the topic and develop strategies to address these misconceptions.	Highly relevant and clear. No changes needed.	No revision was needed. The item was deemed clear and pedagogically sound, so it was retained.
5) The lesson conveys new information to the learners through demonstration, illustration, or explanation of a model, concepts, skills, etc.	Highly relevant and clear. No changes needed.	No revision was required. The item was considered clear and aligned with instructional practices.
6) The lesson regularly checks the learners' understanding. Implement formative assessment techniques to monitor student understanding.	Highly relevant and clear. No changes needed.	The item was retained without changes, as it already included guidance on formative assessment practices and was considered highly relevant.
7) The activity is creative, clear, suitable for the topic, and aligns with the learning outcomes and objectives.	Highly relevant and clear. No changes needed.	No revisions were made. The statement was maintained due to its clarity, creativity emphasis, and alignment with learning outcomes.

8) The activity is effective for activating background knowledge. Activities and strategies were sequenced to convey key concepts.	Highly relevant and clear. No changes needed.	No revision needed. The validators found the item well-stated and relevant to lesson sequencing and background knowledge activation.
9) The activities are suitable for this type of learner.	Highly relevant but can be clearer. Consider revising to: "The activities are tailored to the specific needs and characteristics of the learners."	The wording was revised to clarify how the activity aligns with learner characteristics. The phrase "suitable for this type of learner" was expanded to explicitly mention tailoring to learner needs.
10) Integrate opportunities for students to discuss ideas in small groups, draw a mind map, think of a list of pros and cons, etc.	Highly relevant and clear. No changes needed.	Retained as is. The statement already included examples and was considered detailed and applicable.
11) It asks relevant questions to guide students' thinking, and the teacher candidate provides the expected answer to the question.	Highly relevant but can be clearer. Consider revising to" "Relevant questions are asked to guide students' thinking, and the teacher provides expected answers."	The sentence structure was revised to improve clarity. The passive construction was simplified to improve flow.
12) The assessment reflects on the effectiveness of the lesson in achieving objectives.	Highly relevant and clear. No changes needed.	No revision necessary. The item was retained due to its clarity and alignment with reflective assessment practices.
13) The assessment focuses on using and applying knowledge and skills in real-life situations.	Highly relevant and clear. No changes needed.	The statement was maintained as is, as it clearly reflected application of knowledge in real-life contexts.
14) The lesson plan clearly provides a summary or wrap-up activity to showcase students' learning.	Highly relevant and clear. No changes needed.	No changes were made. The item was found to be clear, relevant, and essential for summarizing student learning.
15) The take-home assignment reflects and relates to real-life situations	Highly relevant and clear. No changes needed.	The item was retained without changes since it effectively emphasizes real-life relevance of take-home tasks.

Table 3 presents the post-validation phase of the Lesson Plan Analysis Tool for Science (LPATS), involving a comprehensive review of the revised instrument by expert validators. Their feedback affirmed the clarity, alignment, and instructional value of many items, while also identifying opportunities for refinement to enhance the tool's clarity, precision, and applicability across varied classroom contexts.

Several items (Items 3, 4, 5, 6, 7, 8, 10, 12, 13, 14, and 15) were considered highly relevant and clearly stated, requiring no further modifications. These items effectively addressed core elements of lesson planning such as learner engagement, misconception handling, delivery of new content, formative assessment, activity design, student collaboration,

and real-life application of knowledge. As such, they were retained in their current form.

For the remaining items, specific actions were taken based on the validators' suggestions:

- Item 1 was revised to clarify the acronym "SMART." Spelling out the components—specific, measurable, achievable, relevant, and time-bound—ensures that all users, including novice teacher candidates, can easily interpret and apply the standard when formulating objectives.
- Item 2 underwent refinement to improve clarity and conciseness. The original phrase "an excellent pre-assessment strategy" was replaced with "an effective pre-assessment strategy," providing a more objective and precise descriptor. The revision ensures that the item remains focused on both eliciting prior knowledge and establishing real-life relevance.
- Item 9 was updated to improve specificity. The original statement referring to activities as "suitable for this type of learner" was revised to: *"The activities are tailored to the specific needs and characteristics of the learners."* This change strengthens the alignment with differentiated instruction and learner-centered planning.
- Item 11 was revised to enhance grammatical clarity and improve flow. The revised statement— *"Relevant questions are asked to guide students' thinking, and the teacher provides expected answers"*—retains the core intent while offering a clearer and more direct expression of effective questioning strategies.

Through this iterative validation process, LPATS was further refined to ensure that each item not only reflects best practices in science instruction but also communicates these practices in an accessible and actionable manner. The validators' comments affirmed the instrument's alignment with pedagogical standards and emphasized its utility in evaluating the lesson planning competencies of preservice teachers.

By addressing minor ambiguities and refining language for clarity and precision, the post-validation phase contributed meaningfully to the tool's content validity. These enhancements support LPATS's role in promoting reflective, evidence-based planning practices in science education.

The findings of this validation study underscore the importance of a well-structured and content-validated assessment tool in reliably evaluating lesson planning competence among preservice and in-service science teachers. The refinement process, informed by expert consensus and systematic evaluation, aligns with previous studies emphasizing the role of clear, criterion-referenced tools in improving instructional quality and supporting professional development (Aksornkool & Frazee, 2020).

Compared to existing tools, LPATS offers a more domain-specific and pedagogically grounded framework tailored to science education, particularly emphasizing critical thinking, real-world application, and formative assessment practices. These features position LPATS as a valuable resource for teacher education programs seeking to enhance instructional design and promote reflective practice in lesson planning. The qualitative feedback provided by the validators aligns with the results of the content validity indices presented in Table 4, further supporting the instrument's overall validity and appropriateness for its intended purpose.

Table 4:
Content Validity Index LPATS (Post-validation)

item	Rater 1	Rater 2	Rater 3	No. in agreement	Experts	ICVI	Pc	Kappa	Interpretation	Decision
1	1	1	1	3	3	1.00	0.125	1.000	Excellent	Retain
2	1	1	1	3	3	1.00	0.125	1.000	Excellent	Retain
3	1	1	1	3	3	1.00	0.125	1.000	Excellent	Retain
4	1	1	1	3	3	1.00	0.125	1.000	Excellent	Retain
5	1	1	1	3	3	1.00	0.125	1.000	Excellent	Retain
6	1	1	1	3	3	1.00	0.125	1.000	Excellent	Retain
7	1	1	1	3	3	1.00	0.125	1.000	Excellent	Retain
8	1	1	1	3	3	1.00	0.125	1.000	Excellent	Retain
9	1	1	1	3	3	1.00	0.125	1.000	Excellent	Retain
10	1	1	1	3	3	1.00	0.125	1.000	Excellent	Retain
11	1	1	1	3	3	1.00	0.125	1.000	Excellent	Retain
12	1	1	1	3	3	1.00	0.125	1.000	Excellent	Retain
13	1	1	1	3	3	1.00	0.125	1.000	Excellent	Retain
14	1	1	1	3	3	1.00	0.125	1.000	Excellent	Retain
15	1	1	1	3	3	1.00	0.125	1.000	Excellent	Retain

S-CVI/Ave = 1.0
S-CVI/UA = 1.0

Table 4 presents the results of the post-validation phase, indicating unanimous agreement among expert reviewers regarding the relevance of every item in the Lesson Plan Assessment Tool for Science (LPATS). Achieving perfect scores across the Item Content Validity Index (I-CVI = 1.00), probability of chance agreement (Pc), and Kappa ($\kappa = 1.00$), the data reflect impeccable inter-rater consistency. Both the average and universal-agreement methods used to calculate the Scale Content Validity Index (S-CVI) further confirm that all items are consistently rated as highly pertinent to the target construct. These findings demonstrate the instrument's exceptional content validity.

The practical implications of LPATS for teacher education are substantial. The instrument serves as a meticulously validated framework

for evaluating lesson planning competence in science, thereby supporting professional growth among preservice and in-service teachers. Rubric-driven evaluation has been shown to enhance clarity of expectations, improve inter-rater reliability, and strengthen reflective practice (Vogelsang et al., 2022). In science education contexts, structured rubrics have consistently promoted reflective teaching and improved lesson design quality (Lee et al., 2021). By integrating domain-specific criteria such as formative assessment, real-world relevance, and questioning strategies, LPATS advances on existing rubrics by aligning closely with inquiry-based and authentic science instruction (Rodrigues-Silva & Alsina, 2023). Consequently, LPATS offers teacher educators a powerful tool for diagnostic feedback, targeted professional development, and enhanced pedagogical planning in science curricula.

CONCLUSION

This study confirms that the Lesson Plan Assessment Tool for Science (LPATS) meets its core objectives: it is a structured, output-based instrument with strong content validity, as demonstrated by perfect I-CVI and S-CVI scores and unanimous expert agreement. LPATS effectively captures key elements of high-quality science lesson planning, including prior knowledge activation, alignment of objectives and assessments, and use of inquiry-based strategies, indicating its sound theoretical and structural foundation.

Practically, LPATS serves as a valuable tool for assessing and guiding lesson planning in science teacher education. Its clear criteria and flexible design make it suitable for various instructional models, supporting formative assessment, curriculum development, and professional growth. To enhance its broader applicability, future studies should explore its construct validity and reliability across diverse educational settings.

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REFERENCES

Aksornkool, N., & Frazee, D. (2020). Developing lesson planning competencies in preservice teachers: A framework-based approach. *Journal of Education and Practice, 11*(5), 23–30.

https://doi.org/10.7176/JEP

Carlson, J., Daehler, K. R., Alonzo, A., Barendsen, E., Berry, A., Borowski, A., ... Wilson, C. D. (2019). The refined consensus model of pedagogical content knowledge in science education. In A. Hume, R. Cooper, & A. Borowski (Eds.), *Repositioning pedagogical content knowledge in teachers' knowledge for teaching science* (pp. 77–92). Springer. https://doi.org/10.1007/978-981-13-5898-2_2

Department of Education. (2016). *Policy guidelines on lesson preparation for the K–12 basic education program (DepEd Order No. 46, s. 2016)*.

Enama, P. R. B. (2021). Student teachers' competence in lesson planning during microteaching. *Journal of Teacher Education and Educators, 10*(3), 341–368.

Fabelico, F. L., & Afalla, B. T. (2023). Revisiting the curriculum: Insights from pedagogical competence and academic performance of preservice teachers. *Cogent Education, 10*(2). https://doi.org/10.1080/2331186X.2023.2272597

Gejdošová, B., & Velmovská, K. (2024). Creation of an evaluation rubric for the assessment of written preparation for teaching physics. *Journal of Physics: Conference Series, 2750*(1), 012040. https://doi.org/10.1088/1742-6596/2750/1/012040

Großmann, L., & Krüger, D. (2024). Assessing the quality of science teachers' lesson plans: Evaluation and application of a novel instrument. *Science Education, 108*(1), 153–189. https://doi.org/10.1002/sce.21832

Khofiyah. (2022). *Kepemimpinan kepala madrasah dalam meningkatkan kompetensi guru di MTs Ma'arif NU Kaligiri Sirampog Brebes* (Order No. 31251199). ProQuest. https://www.proquest.com/dissertations-theses/kepemimpinan-kepala-madrasah-dalam-meningkatkan/docview/3034132386/se-2

Kopp, M., Witty, C., & Vernon, G. (2025). A lesson plan for lesson planning lessons. *Teaching and Learning in Nursing, 20*(1), 43–47. https://doi.org/10.1016/j.teln.2024.07.024

Krepf, M., & König, J. (2023). Structuring the lesson: An empirical investigation of pre-service teacher decision-making during the planning of a demonstration lesson. *Journal of Education for Teaching, 49*(5), 911–926. https://doi.org/10.1080/02607476.2022.2151877

Lee, W. (2020). *A qualitative study of collaborative lesson planning for teachers of students with significant cognitive disabilities* (Order No. 28646597). ProQuest. https://www.proquest.com/dissertations-theses/qualitative-

study-collaborative-lesson-planning/docview/2566231384/se-2

Lee, O., Buxton, C. A., Lewis, S., & LeRoy, K. (2021). Motivating teaching, sustaining change in practice: Design principles for teacher professional learning in science. *Journal of Science Teacher Education, 32*(7), 757–779. https://doi.org/10.1080/1046560X.2020.1864099

Polit, D. F., & Beck, C. T. (2004). *Nursing research: Principles and methods* (7th ed.). Lippincott Williams & Wilkins.

Polit, D. F., & Beck, C. T. (2006). The content validity index: Are you sure you know what's being reported? Critique and recommendations. *Research in Nursing & Health, 29*(5), 489–497. https://doi.org/10.1002/nur.20147

Polit, D. F., Beck, C. T., & Owen, S. V. (2007). Is the CVI an acceptable indicator of content validity? Appraisal and recommendations. *Research in Nursing & Health, 30*(4), 459–467. https://doi.org/10.1002/nur.20199

Richey, R. C., & Klein, J. D. (2014). Design and development research. In J. Spector, M. Merrill, J. Elen, & M. Bishop (Eds.), *Handbook of research on educational communications and technology* (pp. 1–27). Springer. https://doi.org/10.1007/978-1-4614-3185-5_12

Rodrigues Silva, J., & Alsina, I. (2023). Developing an evaluation rubric for planning and assessing socioscientific issues (SSI)-based science STEAM programs. *International Journal of Science and Mathematics Education.* Advance online publication. https://doi.org/10.1007/s11165-023-10123-8

Vathanavong, T., Tungkasamit, A., & Thinwiangthong, S. (2024). Enhancing professional development with lesson study training for lecturers at higher education institutions in Lao PDR. *FWU Journal of Social Sciences, 18*(1), 104–119. https://doi.org/10.51709/19951272/Spring2024/8

Vogelsang, C., Kulgemeyer, C., & Riese, J. (2022). Learning to plan by learning to reflect? Exploring relations between professional knowledge, reflection skills, and planning skills of preservice physics teachers in a one-semester field experience. *Education Sciences, 12*(7), 479. https://doi.org/10.3390/educsci12070479

Zamanzadeh, V., Ghahramanian, A., Rassouli, M., Abbaszadeh, A., Alavi-Majd, H., & Nikanfar, A. R. (2015). Design and implementation of a content validity study: Development of an instrument for measuring patient-centered communication. *Journal of Caring Sciences, 4*(2), 165–178.

Zaragoza, A., Seidel, T., & Hiebert, J. (2021). Exploring preservice

teachers' abilities to connect professional knowledge with lesson planning and observation. *European Journal of Teacher Education*, *44*(5), 1–20. https://doi.org/10.1080/02619768.2021.1996558

Zimmermann, F., Melle, I., & Huwer, J. (2021). Developing prospective chemistry teachers' TPACK: A comparison between students of two different universities and expertise levels regarding their TPACK self-efficacy, attitude, and lesson planning competence. *Journal of Chemical Education, 98*(6), 1863–1874. https://doi.org/10.1021/acs.jchemed.0c01296

Appendix A. The Lesson Plan Assessment Tool for Science (LPATS)

Lesson Plan Assessment Tool for Science (LPATS)

The Lesson Plan Assessment Tool for Science (LPATS) is designed to evaluate the quality of science lesson plans as a reflection of teachers' competence in lesson planning. Developed by the researcher, the tool draws on the theoretical framework proposed by Enama (2021) and aligns with the standards outlined in the Philippine Department of Education Order No. 42, series of 2016. The instrument is organized into three core components: pre-lesson preparation, the instructional delivery phase, and post-lesson activities.

Instructions: Each component of the lesson plan should be evaluated systematically using the criteria outlined below. Assess the level of demonstrated competence by selecting one of the following categories: *Highly Competent*, *Fairly Competent*, or *Needs Improvement*, in accordance with the descriptors provided for each dimension.

Highly Competent (Score: 3) – The lesson demonstrates a high level of proficiency in the targeted planning skill. The teacher exhibits clear mastery, with intentions and instructional actions that are coherent, concise, and appropriate for the classroom context. Strategies employed are well-aligned with learning objectives. No element is missing.

Fairly Competent (Score: 2) – The lesson shows an adequate level of competence in the targeted planning skill. The teacher's intentions and actions are generally appropriate but may lack clarity or depth in some areas. The strategy used is not the best to maximize student's understanding of the content. Some of the instructions are not clear.

Needs Improvement (Score: 1) – The lesson demonstrates limited competence in the targeted planning skill. The teacher's intentions and instructional actions are unclear, inappropriate, or insufficiently developed. The selected strategies may not support the intended learning outcomes, and one or more essential elements are missing or poorly executed.

Indicators	Rating	Recommendations
Before the lesson		
1) Define clear learning objectives that are SMART and aligned with the curriculum standards.		
2) Prior knowledge is elicited in a manner that allows students to connect it to real-life experiences, or a well-designed pre-assessment strategy is implemented to accurately gauge students' existing knowledge.		
3) The lesson engages the learners by getting their attention, raising questions in their minds, stimulating their thinking or getting them interested or ready to learn.		
4) Tries to identify common student misconceptions related to the topic and develop strategies to address these misconceptions.		
The lesson Proper		
5) The lesson conveys new information to the learners through demonstration, illustration, or explanation of a model, concepts, skills etc.		
6) The lesson regularly checks the learners' understanding. Implement formative assessment techniques to monitor student understanding.		
7) The activity is creative, clear, suitable for the topic and aligns with the learning objectives.		
8) The activity is effective for activating background knowledge. Activities and strategies were sequenced to convey key concepts.		
9) The activities are suitable for this type of learner.		
10) Integrate opportunities for students to discuss ideas in small groups, draw a mind map, think of a list of pros and cons etc.		
After the Lesson		
11) It asks relevant questions to guide student's thinking, and the teacher provides the expected answer to the question.		
12) The assessment reflects on the effectivenessof the lesson in achieving objectives.		
13) The assessment focuses in using and applying knowledge and skills in real life situations.		
14) The lesson plan clearly provides a summary or wrap-up activity to showcase students' learning.		
15) The take home assignment reflects and relates to real-life situations.		
Overall		