

Review Materials in Mathematics for Pre-Service Teachers: An EARIST Model for Licensure Examination Readiness

Ailene R. Tuzon

Eulogio “Amang” Rodriguez Institute of Science and Technology

artuzon@earist.edu.ph

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ABSTRACT

This study developed and validated Review Materials in Mathematics for Pre-Service Teachers as an EARIST Model for Licensure Examination Readiness. It examined the recent LET performance of BSE-Mathematics graduates, developed a competency-based review material, determined its overall quality in terms of content validity, reliability, difficulty, discrimination, and predictive validity, and assessed its acceptability in terms of content accuracy, administrability, clarity, scorability, and usefulness. The study employed a descriptive-developmental research design involving 201 respondents composed of 18 school administrators, 60 Mathematics experts, and 123 BSE-Mathematics pre-service teachers.

Purposive sampling was used to obtain expert and learner participants who were directly relevant to the development, validation, and pilot testing of the review material. Data were gathered using researcher-developed evaluation tools, expert validation forms, pilot-test responses, and LET performance records, and were analyzed using frequency, percentage, weighted mean, Content Validity Index, KR-20 reliability coefficient, item difficulty and discrimination indices, Pearson Product-Moment Correlation, and independent samples t-test. Findings showed that LET performance fluctuated from 45.45% to 75.00% across the last three years, indicating the need for a structured intervention. The developed review material obtained excellent content validity ($S-CVI/Ave = 0.93$), very high reliability ($KR-20 = 0.87$), moderate difficulty (mean $p = 0.53$), good discriminating power (mean $D = 0.38$), and significant predictive validity with mock LET performance ($r = 0.68$, $p = 0.000$). It was rated highly acceptable overall ($WM = 4.29$), with usefulness obtaining the highest composite mean ($WM = 4.32$). The results support the institutionalization of the review materials as a structured, LET-aligned, and evidence-based resource for strengthening Mathematics licensure examination readiness among pre-service teachers.

Keywords: *licensure examination readiness, Mathematics review materials, pre-service teachers, EARIST model, content validity, teacher education*

INTRODUCTION

The Licensure Examination for Teachers (LET) plays a critical role in regulating entry into the teaching profession in the Philippines. Beyond certification, it functions as a mechanism for determining whether teacher education graduates have acquired the minimum competencies expected of beginning professional teachers. For pre-service teachers majoring in Mathematics, this examination is particularly demanding because it requires mastery of mathematical content, analytical reasoning, accurate problem-solving, and the ability to apply concepts across unfamiliar contexts. The legal mandate for quality higher education and teacher licensure is reinforced by

Republic Act No. 7722 and Republic Act No. 7836, which situate teacher preparation within national standards for professional competence and institutional accountability.

Despite formal academic preparation in higher education institutions, many Mathematics graduates continue to encounter difficulty in achieving licensure results that fully reflect their years of training. Prior studies cited in the source manuscript indicate gaps between coursework, institutional review practices, and licensure examination demands, particularly in specialization areas such as Mathematics (Dela Fuente, 2021; Fiscal & Roman, 2022). These gaps suggest that conventional instruction and commercially available review materials may be insufficient when they are not aligned with institutional curricula, learner profiles, and the actual competencies assessed in the LET (Gabor & Montillano, 2025; Soliman, 2022).

At Eulogio “Amang” Rodriguez Institute of Science and Technology (EARIST), strengthening licensure examination readiness among pre-service Mathematics teachers has become an important institutional priority. Although graduates receive foundational preparation in mathematical content and pedagogy, the source study noted the absence of a unified review framework that integrates diagnostic assessment, structured content review, practice testing, and reflective feedback. Review efforts were often dependent on individual initiatives, external review centers, or short-term interventions conducted near the examination period. Such practices may provide support but may not adequately address accumulated gaps in mathematical understanding and licensure readiness.

This study responded to that need by developing Review Materials in Mathematics for Pre-Service Teachers: An EARIST Model for Licensure Examination Readiness. The proposed model conceptualized review materials not as isolated last-minute interventions but as systematic, research-based, and competency-aligned academic resources embedded within teacher education preparation. The study specifically examined the LET performance of BSE-Mathematics graduates, developed a Mathematics review material based on the identified need, validated its quality through content and psychometric indices, assessed its acceptability among school administrators and Mathematics experts, and determined whether significant differences existed in respondent assessments. In doing so, the study contributes to teacher education by presenting a localized, evidence-based, and institution-responsive model for supporting pre-service Mathematics teachers before professional licensure.

Literature Review

Licensure Examination Readiness and Mathematics Teacher Preparation

The reviewed literature emphasized that quality Mathematics teacher preparation requires more than the completion of degree requirements. Local sources cited in the thesis argued that teacher education must develop mathematical content mastery, pedagogical competence, learner-centered instruction, and curriculum responsiveness. Calma (2025) emphasized the importance of teachers' deep conceptual knowledge in facilitating meaningful mathematical discourse, while Martin (2023) argued that disciplinary expertise must be accompanied by strategies that cultivate learners' analytical reasoning and problem-solving abilities. These perspectives support the study's assumption that review materials for pre-service Mathematics teachers should develop both conceptual understanding and professional competence.

Foreign literature similarly highlighted the multidimensional nature of teacher competence. Cooper (2025) emphasized continuous professional learning among Mathematics teachers, while Lee (2023) underscored the importance of clear communication, enthusiasm, and the ability to connect abstract concepts to real-life situations. Brittain (2025) warned against excessive reliance on routine exercises, and Derrow (2025) cautioned that reduced rigor and inadequate mastery may weaken future academic outcomes. Together, these studies justify the development of review resources that do not merely drill examinees but also promote understanding, reasoning, and readiness for professional practice.

Content and Response Theories in Review Material Development

The theoretical foundation of the study was anchored on Content Theory and Response Theory. Content Theory supports the principle that instructional materials are valid and effective when they accurately represent the domain of knowledge and competencies they intend to develop. In educational measurement, this assumption is closely related to content validity, wherein materials and assessment instruments must reflect intended curriculum standards and learning outcomes (American Educational Research Association et al., 2014). In the present study, Content Theory guided the selection of mathematical domains such as Algebra, Geometry, Trigonometry, Calculus, Statistics and Probability, Number Theory, Logic and Set Theory, Mathematical Investigation and Modeling, Technology in Mathematics Teaching, Assessment of Learning, Research in Mathematics Education, and Problem Solving.

Response Theory, rooted in Item Response Theory, complements Content Theory by explaining how learners' responses to assessment items reflect underlying competence and readiness. Embretson and Reise (2000) and Hambleton et al. (1991) emphasized that item quality, difficulty, and discrimination are essential in measuring learner ability. In this study, Response Theory supported the use of item analysis, reliability testing, and predictive validity to determine whether the developed review material generated dependable evidence of LET readiness. This theoretical integration strengthened the study because the review material was evaluated both as an instructional resource and as an assessment-based readiness tool.

Competency-Based Review Materials and Assessment Quality

Empirical studies reviewed in the thesis consistently affirmed the value of diagnostic assessment and structured review programs. Fiscal and Roman (2022) found that pre-board examination performance can serve as a reliable predictor of LET results, while Dela Fuente (2021) reported that intensive review classes strengthened licensure performance, particularly when focused on specialization and professional education components. Gabor and Montillano (2025) likewise emphasized the need for organized review sessions, mentoring, academic coaching, and examination strategy workshops to address difficulties experienced by graduates preparing for licensure.

The same body of literature supports the validation of instructional resources before implementation. Avelino (2025) reported the value of diagnosing competency deficiencies before graduation, while Arhin et al. (2025) documented inadequate mastery among pre-service teachers in domains such as Algebra, Geometry, Data, and Chance, underscoring the need for systematic assessment. These findings support the present study's emphasis on Content Validity Index, reliability, difficulty index, discrimination index, and predictive validity as quality indicators of a review material intended for licensure examination readiness.

Institutional Support, Technology, and Professional Readiness

The reviewed literature also emphasized institutional responsibility in strengthening teacher preparation. Mallari (2023) stressed the importance of collaboration among teacher education institutions, CHED, and DepEd to maintain curriculum responsiveness, while Sison (2023) viewed teacher competence as a lifelong developmental process requiring sustained professional learning. In the context of licensure preparation, these perspectives suggest that institutions should provide structured, localized, and competency-aligned support systems rather than relying solely on external review centers or short-term review activities.

Recent studies also recognized technology and innovation as emerging dimensions of Mathematics teacher preparation. Bajado (2025) found that readiness to use digital mathematical tools supports future instructional competence, while Ngoako and Pule (2025) and Owaba (2024) emphasized the increasing relevance of digital technologies and artificial intelligence in Mathematics instruction. Bui et al. (2025) further reported that engagement with generative artificial intelligence may influence teachers' instructional readiness and professional learning. These studies reinforce the need for review materials that are not only content-aligned but also adaptable, relevant, and capable of supporting future enhancements in Mathematics education.

Conceptual Framework of the Study

The conceptual framework of the study followed the Input-Process-Output model. The input consisted of respondents, LET performance data, validation and psychometric indices, acceptability indicators, and references used in developing the review material. The process involved validation, pilot testing, administration of survey questionnaires, statistical treatment, analysis, and interpretation. The output was the validated Review Materials in Mathematics for Pre-Service Teachers under the EARIST Model for Licensure Examination Readiness.

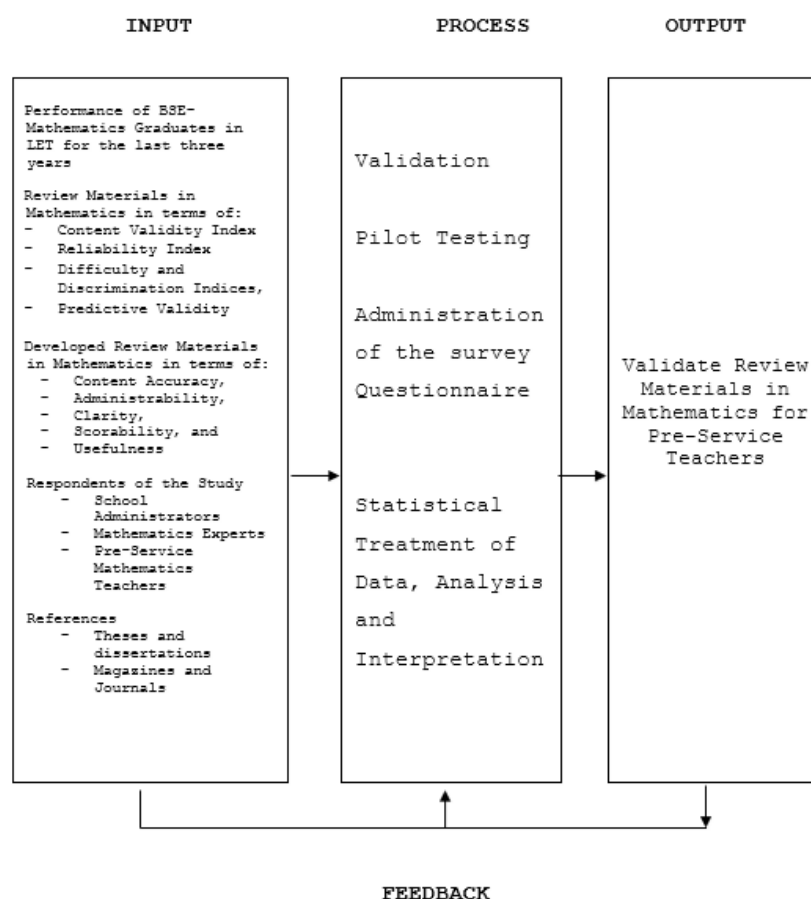


Figure 1. Conceptual framework of the study.

METHODS

Research Design

The study employed a descriptive-developmental research design. This design was appropriate because the study aimed to develop, validate, and evaluate instructional review materials intended to address identified educational needs related to Mathematics licensure examination readiness. The descriptive component assessed the acceptability and psychometric soundness of the developed materials, while the developmental component focused on producing a competency-based instructional product aligned with LET Mathematics requirements.

Research Locale

The study was conducted at the Eulogio “Amang” Rodriguez Institute of Science and Technology (EARIST) during School Year 2025–2026. EARIST was the appropriate setting because the proposed model was developed as an institution-based review material intended to strengthen licensure examination readiness among BSE-Mathematics pre-service teachers.

Participants and Sampling Technique

Purposive sampling was used to select participants who were directly relevant to the development, evaluation, and pilot testing of the review materials. The study involved 201 respondents from a population of 222, equivalent to 90.54% participation. The respondents were composed of 18 school administrators, 60 Mathematics experts, and 123 BSE-Mathematics pre-service teachers. The pre-service teachers participated in pilot testing, while the school administrators and Mathematics experts evaluated the acceptability of the developed review material.

Table 1. *Population and sample of the study*

Respondents	Population (N)	Sample (n)	Percentage
School Administrators	20	18	90.00
Mathematics Experts	75	60	80.00
Pre-Service Teachers	127	123	96.85
Total	222	201	90.54

Research Instrument

The primary instrument was a researcher-developed evaluation tool designed to assess the quality and acceptability of the mathematics review materials. It consisted of structured checklists and rating scales used by school administrators and Mathematics experts to evaluate content accuracy, administrability, clarity, scorability, and usefulness. The study also used pilot-test responses of pre-service teachers to determine item quality through reliability, difficulty, discrimination, and predictive validity analyses.

Data Gathering Procedure

Permission was secured from the Graduate School or Research Office and concerned program heads prior to data collection. The researcher developed an initial draft of the review material based on LET Mathematics content areas, CHED and teacher education curriculum competencies, and identified needs of pre-service teachers. The draft material and evaluation checklist were submitted to experts for validation and acceptability assessment. The material was then revised based on validators' comments before pilot testing among pre-service teachers. Pilot-test data were analyzed to determine item difficulty, discrimination, reliability, and predictive validity. The final version of the review material was prepared after incorporating results from validation, pilot testing, and statistical analysis.

Data Analysis

Frequency and percentage were used to describe respondent groups and LET performance. Weighted mean and ranking were used to interpret acceptability ratings. Content Validity Index was used to determine the relevance of items. KR-20 reliability coefficient measured internal consistency. Difficulty and discrimination indices evaluated the quality of the assessment items. Pearson Product-Moment Correlation was used to determine the relationship between scores in the developed review material and mock LET performance, while independent samples t-test determined significant differences between the assessments of school administrators and Mathematics experts. Statistical significance was tested at the 0.05 level.

Ethical Consideration

The study observed ethical procedures by securing institutional permission before data gathering and by using the collected data solely for academic research purposes. Respondents participated based on their relevance to the validation and pilot-testing process. Their assessments and responses were treated confidentially and used only for the development, validation, and improvement of the review materials.

RESULTS AND DISCUSSION

LET Performance of BSE-Mathematics Graduates

The LET performance of BSE-Mathematics graduates fluctuated across the last three years. The highest overall passing rates were recorded in March 2025 and March 2026, both at 75.00%, while the lowest rate was recorded in March 2023 at 45.45%. Although September 2025 showed a temporary decline at 55.56%, the overall pattern from March 2023 to March 2026 indicated improvement in licensure performance. These results provided a direct basis for developing a structured review material that could strengthen academic preparation and reduce inconsistency in future LET outcomes.

Table 2. *Performance of BSE-Mathematics graduates in the LET for the last three years*

Year	Month	No. of LET Takers	First Takers Passed (%)	Repeaters Passed (%)	Overall Passed (f)	Overall Rate (%)
2026	March	24	72.73	76.92	18	75.00
2025	September	18	75.00	40.00	10	55.56
2025	March	12	100.00	62.50	9	75.00
2024	September	11	66.67	100.00	8	72.73
2024	March	13	75.00	60.00	9	69.23
2023	September	15	57.14	62.50	9	60.00
2023	March	11	57.14	25.00	5	45.45

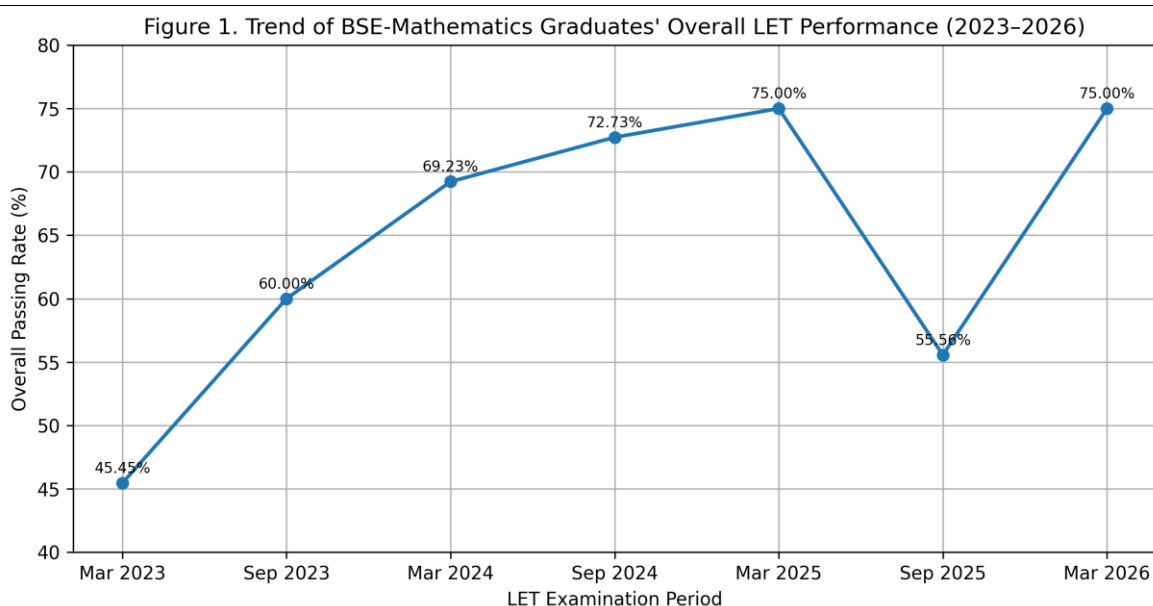


Figure 2. *Trend of BSE-Mathematics graduates' overall LET performance, 2023–2026.*

The findings are consistent with studies emphasizing the need for structured licensure preparation. Gabor and Montillano (2025) reported that graduates preparing for licensure may be motivated yet still experience challenges in study discipline, STEM mastery, and external constraints. Fiscal and Roman (2022) also highlighted that pre-board or mock examination results can guide targeted intervention. Thus, the fluctuating performance of EARIST BSE-Mathematics graduates justified the development of a competency-based and LET-aligned review material.

Developed Review Materials in Mathematics

Based on the observed variability in LET performance, the study developed Review Materials in Mathematics for Pre-Service Teachers. The material was designed to align with the LET Table of Specifications and the competencies expected of Mathematics majors. It included structured content review, competency-based activities, practice assessments, and mechanisms for identifying areas that require further remediation. The material therefore served both instructional and diagnostic purposes, consistent with the combined assumptions of Content Theory and Response Theory.

Overall Quality of the Developed Review Material

The developed review material demonstrated strong quality indicators. The Content Validity Index showed that 138 of the 150 items obtained an I-CVI of 0.80 and above, while 12 items with an I-CVI of 0.70 were revised. The overall S-CVI/Ave was 0.93, interpreted as excellent content validity. The KR-20 reliability coefficient of 0.87 indicated very high internal consistency. The mean difficulty index was 0.53, interpreted as moderately difficult, while the mean discrimination index was 0.38, interpreted as good discriminating power. Predictive validity also showed a strong positive and significant relationship between review material scores and mock LET performance ($r = 0.68$, $p = 0.000$).

Table 3. Overall quality of the developed review material

Quality Indicator	Result	Interpretation / Decision
Content Validity Index	S-CVI/Ave = 0.93; 138 items retained; 12 items revised	Excellent content validity; validated and approved
Reliability Index	KR-20 = 0.87 for 150 items	Very high reliability
Difficulty Index	Mean $p = 0.53$; 98 items in ideal zone	Moderately difficult; optimal difficulty
Discrimination Index	Mean $D = 0.38$; 85 excellent and 42 good items	Good discriminating power
Predictive Validity	$r = 0.68$, $p = 0.000$	Strong positive relationship; significant

These results indicate that the review materials were not only aligned with the competencies assessed in the LET but also supported by psychometric evidence. The significant predictive relationship means that higher performance on the developed review material was associated with higher mock LET performance. This finding strengthens the instructional and assessment value of the material as a tool for determining and improving licensure readiness.

Acceptability of the Developed Review Material

School administrators and Mathematics experts rated all acceptability dimensions as highly acceptable. Usefulness obtained the highest composite weighted mean ($WM = 4.32$), followed by content accuracy ($WM = 4.31$), administrability ($WM = 4.30$), clarity ($WM = 4.30$), and scorability ($WM = 4.25$). The overall weighted mean was 4.29, verbally interpreted as Highly Acceptable. These results show that the developed review materials were perceived as accurate, practical, understandable, objectively scorable, and useful for strengthening Mathematics licensure readiness.

Table 4. *Summary of acceptability ratings of the developed review material*

Variables	School Administrators WM/VI	Mathematics Experts WM/VI	Composite WM/VI	Rank
Content Accuracy	4.28 / HA	4.33 / HA	4.31 / HA	3
Administrability	4.29 / HA	4.30 / HA	4.30 / HA	3

Clarity	4.28 / HA	4.32 / HA	4.30 / HA	3
Scorability	4.23 / HA	4.27 / HA	4.25 / HA	5
Usefulness	4.30 / HA	4.33 / HA	4.32 / HA	1
Overall Weighted Mean	4.28 / HA	4.31 / HA	4.29 / HA	

The high rating for usefulness suggests that respondents recognized the value of the review material in strengthening mastery of Mathematics concepts, critical thinking, analytical reasoning, and problem-solving skills required in the LET. Although scorability obtained the lowest mean, it remained within the highly acceptable range, indicating that the scoring procedures, answer keys, and assessment components were still viewed as reliable and usable for review sessions.

Differences in Respondents' Assessments

The independent samples t-test revealed significant differences between the assessments of school administrators and Mathematics experts in content accuracy, clarity, scorability, and usefulness. Administrability was the only dimension where no significant difference was found. Overall, the computed t-value of 3.43 exceeded the critical value of 1.997 at the 0.05 level of significance, indicating a significant difference in the overall assessments of the two respondent groups. Despite these differences, both groups consistently rated the review material as highly acceptable.

Table 5. *Significant differences in the assessments of school administrators and Mathematics experts*

Variables	t-value	Interpretation	Decision
Content Accuracy	6.20	Significant	Reject Ho
Administrability	0.88	Not Significant	Fail to Reject Ho
Clarity	5.72	Significant	Reject Ho
Scorability	7.44	Significant	Reject Ho
Usefulness	2.63	Significant	Reject Ho
Overall Weighted Mean	3.43	Significant	Reject Ho

The presence of significant differences suggests that school administrators and Mathematics experts may have emphasized different evaluative priorities. Administrators may have viewed the materials in relation to institutional implementation and program use, whereas Mathematics experts may have focused more closely on technical content, clarity of mathematical presentation, and assessment quality. Nevertheless, the shared highly acceptable ratings indicate convergence on the overall suitability of the materials for institutional LET review programs.

CONCLUSION

The study concluded that BSE-Mathematics graduates' LET performance fluctuated across the last three years, indicating the need for a structured and institution-based intervention to strengthen licensure examination readiness. In response, the developed Review Materials in Mathematics for Pre-Service Teachers provided a competency-based and LET-aligned resource that addressed the academic preparation needs of future Mathematics examinees. The material demonstrated excellent quality through its strong content validity, very high reliability, appropriate difficulty level, good discriminating power, and significant predictive validity. It was also rated highly acceptable in content accuracy, administrability, clarity, scorability, and usefulness by school administrators and Mathematics experts. Although significant differences were found in several respondent

assessments, both groups generally affirmed the review material's suitability for institutional review and enhancement programs. Overall, the EARIST Model for Licensure Examination Readiness contributes a localized, evidence-based, and psychometrically supported review framework for improving Mathematics licensure preparation among pre-service teachers.

Recommendation

The College of Education may adopt and institutionalize the developed Review Materials in Mathematics for Pre-Service Teachers as part of its LET enhancement and intervention programs.

Mathematics faculty members may utilize the developed review material as a supplementary instructional and review resource in Mathematics major courses and organized institutional review sessions.

Pre-service Mathematics teachers may use the review material for independent, guided, and continuous preparation for the Licensure Examination for Teachers.

The College of Education may conduct regular diagnostic, formative, and mock LET examinations using the developed review material to monitor learners' progress and readiness.

Future revisions of the review material may incorporate newly released competencies, emerging trends in Mathematics education, technology-supported review practices, and updates in the LET Table of Specifications.

Similar institution-based review materials may be developed for other teacher education specialization areas to strengthen overall licensure performance.

Future researchers may conduct follow-up studies to determine the effect of the developed review material on actual LET performance and to validate its applicability in other teacher education institutions.

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