



Original Research Paper

Development of an Instrument to Assess Service Quality and Resource Adequacy in Midwifery Laboratories

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Access this article online
Quick Response Code :



DOI: 10.22487/hjt.v12i4.2351

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Page : 775-785

Article History:

Received: 2026-08-21

Revised: 2026-09-28

Accepted: 2026-10-06

Published by:

Tadulako University,
Managed by Faculty of
Medicine.

Website :

<https://jurnal.fk.untad.ac.id/index.php/hjt/index>



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Abstract

Background: Midwifery laboratories are essential for developing clinical competencies, yet service quality and resource adequacy are frequently assessed separately. **Objectives:** This study aimed to develop and internally evaluate an integrated instrument for assessing midwifery laboratory quality. **Methods:** Five experts validated the instrument, and 446 midwifery students with laboratory experience completed a 44 item questionnaire. Psychometric evaluation included content validity, exploratory factor analysis (EFA), preliminary confirmatory factor analysis (CFA), Rasch analysis, and internal consistency testing. **Results:** The average scale content validity index was 0.982. EFA identified six factors explaining 56.96% of total variance, with the first factor contributing 44.02%. Preliminary CFA demonstrated $\chi^2/df = 2.240$, RMSEA = 0.053, SRMR = 0.041, GFI = 0.991, CFI = 0.898, and TLI = 0.886. Rasch person reliability was 0.969, whereas item reliability was 0.641. Cronbach alpha reached 0.970, with corrected item total correlations ranging from 0.561 to 0.739. **Conclusions:** The instrument demonstrated promising internal psychometric properties for evaluating midwifery laboratory quality. However, independent external validation and comprehensive ordinal and Rasch diagnostics remain necessary before broader implementation.

Keywords: Instrument development; Midwifery laboratory; Psychometric evaluation; Resource adequacy; Service quality.

Introduction

Midwifery education requires structured learning environments in which students can rehearse clinical judgement and procedural skills before direct patient care. Published instruments in midwifery education show the value of systematic assessment for competence, professional standards, critical thinking, and clinical performance. Simulation and laboratory learning further support repeated practice in a controlled setting, while the broader clinical learning environment shapes

how students interact with staff, procedures, facilities, and educational resources¹⁻⁸.

Service quality offers a complementary lens for laboratory evaluation. The SERVQUAL tradition emphasizes reliability, responsiveness, assurance, empathy, and tangible conditions, while health service quality research shows that performance depends on the interaction of structures, processes, resources, personnel, and user expectations. In a teaching laboratory, those service dimensions operate together with equipment availability, safe materials, practice

sets, learning media, staff facilitation, and access to resources. Evidence from simulation research also indicates that resources are most useful when combined with sound learning design, feedback, appropriate fidelity, and clear operational support⁹⁻¹⁷.

A methodological gap remains because many midwifery instruments emphasize student competence or performance rather than an integrated evaluation of laboratory service quality and resource adequacy. Current scale development guidance recommends explicit construct definition, systematic item generation, expert review, field testing, and accumulation of evidence across content, internal structure, reliability, and other measurement properties. Content validity therefore requires transparent expert judgement and quantitative evidence rather than reliance on face relevance alone¹⁸⁻²².

The present study addressed this gap by constructing an instrument for students who use a midwifery laboratory. Factor analytic research in health professional education illustrates the need to compare empirical structure with theoretically defined domains, while methodological literature supports cautious joint interpretation of exploratory and confirmatory evidence. Rasch measurement adds information about response patterns, item functioning, and relative difficulty that classical statistics do not provide²³⁻³².

Reliability was treated as one component of measurement quality rather than a substitute for validity because coefficient alpha is affected by dimensionality, scale length, and model assumptions. The study therefore sought to develop and internally evaluate an instrument integrating laboratory service quality and resource adequacy using content validity, factor analysis, Rasch analysis, and internal consistency evidence. The intended contribution is a structured local evaluation tool that can inform laboratory improvement while

remaining subject to independent external validation³³⁻³⁷.

Materials and Methods

Study Design

This quantitative instrument development study was conducted in the Midwifery Laboratory of Poltekkes Kemenkes Jakarta I during the 2026 research implementation period. The development sequence comprised construct definition, item generation, expert judgement, wording revision, field administration, and psychometric evaluation. Two broad aspects were specified before statistical testing: laboratory service quality and adequacy of equipment and resources. These aspects were represented by 11 conceptual dimensions and 44 positively worded items. The study was designed as an initial internal psychometric evaluation rather than a national or external validation^{18,19,21,22}.

Sample

The target population comprised active midwifery students who had used the laboratory for practical learning and clinical simulation. Purposive sampling was applied, and eligibility required completion of at least one semester of laboratory practice so respondents had direct experience with laboratory procedures, staff services, equipment, materials, safety provisions, and learning resources. A total of 446 students participated, equivalent to approximately 10.1 respondents per item. The retained study documentation identifies the study year as 2026 but does not provide an auditable recruitment denominator for all eligible students, the number invited, refusals, or exclusions beyond the stated eligibility rule; therefore, a response rate was not reconstructed. This limitation was considered when interpreting representativeness and generalizability^{18,23,25}.

Data Collection Technique

Item development began with a conceptual review of laboratory service, facilities, safety, learning support, and resource management. Five expert validators assessed item relevance, clarity, representativeness, and feasibility, after which wording was revised while preserving the intended domains. The available validation output reports item content validity index values and the scale content validity index average, but the archived material supplied for this report does not contain the complete expert rating matrix or sufficiently detailed individual validator profiles to support retrospective reconstruction of professional backgrounds, rating distributions, or a modified kappa coefficient. The final 44 item questionnaire used four ordered response categories from very unsuitable to very suitable, scored from 1 to 4, with higher scores indicating more favorable perceptions of laboratory service and resource adequacy^{19,20}.

Data Analysis Technique

Analysis combined descriptive and psychometric evidence. Descriptive statistics summarized item and dimension scores, score percentages relative to the theoretical maximum, internal consistency, and corrected item total correlations. Exploratory factor analysis output included the Kaiser Meyer Olkin statistic, Bartlett testing, eigenvalues, variance explained, loadings, and communalities. The retained analytic output did not document the extraction method, rotation method, missing data rule, correlation matrix, or estimator used for the four category ordinal responses; these settings were therefore not inferred retrospectively. Confirmatory factor analysis evaluated the theory specified 11 dimension model with chi square divided by degrees of freedom, RMSEA, SRMR, GFI, CFI, and TLI. Because exploratory and confirmatory analyses used the same 446

observations, the confirmatory findings were interpreted as preliminary rather than independent confirmation. The six factor exploratory solution and the 11 dimension theory specified model were treated as complementary but non equivalent representations. Rasch analysis evaluated Infit, Outfit, relative item difficulty, and person and item reliability; separation indices were derived from the reported reliabilities using the standard relationship between reliability and separation. Category thresholds, person item targeting, local dependence, unidimensionality diagnostics, and differential item functioning were not available in the retained output and were not claimed. Cronbach alpha and corrected item total correlations were reported as internal consistency evidence, while McDonald omega was not reconstructed without the item level response matrix^{24-35,37}.

Ethical Consideration

The study received ethical approval from the Health Research Ethics Committee of Poltekkes Kemenkes Jakarta I, approval No. 076/KEPK PKJI/VI/2026. Participation was voluntary, informed consent was obtained before data collection, and study data were handled in aggregate form to protect confidentiality.

Result

All 446 respondents (100%) had completed at least one semester of laboratory practice. Semester 4 students constituted the largest proportion, with 175 participants (39.24%), followed by semester 2 students with 162 participants (36.32%) and semester 6 students with 109 participants (24.44%). The distribution indicates that respondents were predominantly from semesters 2 and 4, collectively accounting for 75.56% of the sample. Consequently, the observed score distribution primarily reflects students at earlier

and intermediate stages of their academic training rather than those in semester 6. This variation in academic progression and laboratory exposure should be considered when interpreting the study findings.

Table 1. Characteristics of respondents

Semester	n	%
2	162	36.32
4	175	39.24
6	109	24.44
All respondents with at least one semester of practice	446	100.00

The final conceptual framework contained two aspects, 11 dimensions, and 44 items. Service quality comprised service reliability, responsiveness, assurance and safety, empathy and communication, physical setting and learning environment, and quality improvement. Resource adequacy comprised equipment adequacy, materials and practice

sets, equipment safety, learning resources, and resource access and management. Expert review produced a scale content validity index average of 0.982. Forty items had an item content validity index of 1.00 and four items had an index of 0.80. No item was removed during the content review stage.

The theoretical total score ranged from 44 to 176. The observed mean total score was 138.15 with a standard deviation of 24.77, equivalent to a mean of 3.140 per item and 78.50% of the theoretical maximum. Dimension percentages ranged narrowly from 78.24% to 78.87%. These values are presented only as descriptive score summaries because validated cut points for poor, moderate, or good laboratory quality were not established. The retained analytic output did not include response frequency distributions sufficient to calculate item or scale floor and ceiling proportions.

Table 2. Dimension profile, descriptive score percentage, and internal consistency

Aspect	Dimension	Items	Mean	Score % of maximum	Alpha
Service quality	Service reliability	4	3.136	78.39	0.801
Service quality	Responsiveness	4	3.141	78.53	0.806
Service quality	Assurance and safety	4	3.139	78.48	0.801
Service quality	Empathy and communication	4	3.133	78.32	0.814
Service quality	Physical setting and learning	6	3.151	78.77	0.891
Service quality	Quality improvement	2	3.135	78.36	0.688
Resource adequacy	Equipment adequacy	4	3.139	78.48	0.812
Resource adequacy	Materials and practice sets	2	3.155	78.87	0.666
Resource adequacy	Equipment safety	4	3.149	78.71	0.820
Resource adequacy	Learning resources	2	3.145	78.62	0.689
Resource adequacy	Resource access and management	8	3.129	78.24	0.906

Exploratory factor analysis showed strong sampling adequacy, with a Kaiser Meyer Olkin value of 0.978 and a significant Bartlett test, chi square 10,836.98 with 946 degrees of freedom, $p < 0.001$. Six factors had eigenvalues above 1 and together explained 56.96% of variance; the first factor accounted for 44.02%, indicating a

strong common component alongside additional dimensions. Preliminary confirmatory analysis of the 11 dimension theory specified model produced chi square divided by degrees of freedom 2.240, RMSEA 0.053, SRMR 0.041, GFI 0.991, CFI 0.898, and TLI 0.886. The CFI and TLI values remained

below 0.90, and use of the same sample for exploration and confirmation requires cautious interpretation. Although the RMSEA and SRMR values suggested acceptable approximate model fit, the marginal incremental fit indices indicated that the

proposed factorial structure was not fully supported by the data. Further validation using an independent sample is recommended to assess the stability, generalizability, and structural validity of the instrument.

Table 3. Summary of psychometric evidence

Evidence	Statistic	Result	Interpretation
Content validity	S CVI Ave	0.982	Strong expert agreement; internal evidence
Exploratory structure	KMO	0.978	Strong sampling adequacy
Exploratory structure	Bartlett test	Chi square 10,836.98; p < 0.001	Correlation structure suitable for factor analysis
Exploratory structure	Variance explained	56.96% across six factors	Six factor empirical solution
Confirmatory structure	Chi square divided by df	2.240	Preliminary fit evidence
Confirmatory structure	RMSEA / SRMR	0.053 / 0.041	Acceptable residual fit indices
Confirmatory structure	GFI	0.991	High absolute fit
Confirmatory structure	CFI / TLI	0.898 / 0.886	Below 0.90; independent confirmation required
Rasch	Mean Infit / Outfit	0.580 / 0.622	Aggregate overfit tendency; inspect item level results
Rasch	Person / item reliability	0.969 / 0.641	High person reliability; moderate item reliability
Internal consistency	Cronbach alpha	0.970	High consistency; possible redundancy
Item discrimination	Corrected item total correlation	0.561 to 0.739	Positive item contribution
Rasch	Person / item separation	5.59 / 1.34	Derived from reported reliabilities; item separation limited

Item level Rasch results were generally within the prespecified practical range, but aggregate mean Infit MNSQ of 0.580 and mean Outfit MNSQ of 0.622 indicate an overall tendency toward overfit rather than evidence of superior fit. Person reliability was 0.969 and item reliability was 0.641. Using the standard reliability to separation relationship, the corresponding separation indices were approximately 5.59 for persons and 1.34 for items, indicating strong differentiation among respondents but limited stability of the item hierarchy. Items A20, B38, and B42 had Outfit values of 0.493, 0.482, and 0.499, respectively. They were retained provisionally because content validity, confirmatory loading, and corrected item total correlation remained supportive, but they require reassessment in

external validation. Detailed item results are provided in Supplementary Table S1.

Cronbach alpha for all 44 items was 0.970, and corrected item total correlations ranged from 0.561 to 0.739. Dimension specific alpha values ranged from 0.666 to 0.906. The high total alpha is consistent with strong score coherence but, together with the dominant first exploratory factor, may also reflect a strong general factor or item redundancy. The two dimensions containing only two items had the lowest alpha values. All 44 items were therefore retained only as a provisional content balanced version pending independent testing of omega, higher order or bifactor structure, test retest stability, and item redundancy.

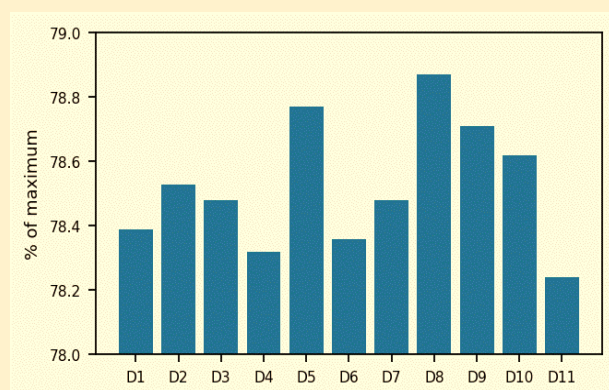


Figure 1. Dimension scores expressed as percentages of the theoretical maximum

The dimension scores were tightly clustered when expressed as percentages of the theoretical maximum. Materials and practice sets had the highest descriptive percentage at 78.87%, whereas resource access and management had the lowest at 78.24%. The narrow range should be interpreted as descriptive information rather than categorical evidence that any dimension is good or poor.

The study produced a 44 item instrument covering service quality and resource adequacy. Content validity and sampling adequacy were strong, the exploratory analysis identified six factors, and the theory specified 11 dimension model showed mixed preliminary confirmatory evidence, with CFI and TLI below 0.90. Rasch person reliability was high, item reliability was moderate, and aggregate fit statistics suggested overfit. Internal consistency was high, but the dominant first factor and alpha of 0.970 warrant evaluation of a general factor and redundancy. Accordingly, the instrument should be viewed as an internally evaluated local tool that requires independent external psychometric confirmation.

Discussion

The principal contribution of this study is an integrated instrument that represents both service quality and resource adequacy within one laboratory evaluation framework. The scale content validity index average of 0.982

indicates strong agreement on content representation among the five validators. However, the available archive does not contain the full expert rating matrix or detailed validator profiles, so chance corrected agreement could not be recomputed and the content evidence should be interpreted as internal rather than definitive. This cautious interpretation is consistent with scale development guidance that treats expert review as one source of validity evidence among several complementary sources¹⁸⁻²².

The exploratory and theory specified structures should not be presented as mutually confirmatory. Six empirical factors explained 56.96% of variance, whereas the instrument was designed around 11 conceptual dimensions. The dominant first factor, which explained 44.02% of variance, suggests a broad common perception of laboratory quality, while the remaining factors indicate additional differentiation. Theoretical domains can remain useful when they represent distinct operational decisions, but future work should compare a correlated factor model with a higher order or bifactor model to determine whether dimension scores add information beyond an overall score²³⁻²⁶.

The preliminary confirmatory results were mixed. Chi square divided by degrees of freedom, RMSEA, SRMR, and GFI were favorable, whereas CFI of 0.898 and TLI of 0.886 did not reach 0.90. Interpretation should therefore avoid claiming established construct validity. In addition, exploratory and confirmatory analyses were conducted on the same 446 participants and the archived output did not preserve the ordinal correlation matrix or estimator settings. These limitations increase the risk of optimistic fit and make independent replication with methods appropriate for ordered categorical responses essential²⁷⁻²⁹.

Rasch findings also require qualification. Person reliability of 0.969 corresponds to

strong person separation, but item reliability of 0.641 and derived item separation of approximately 1.34 indicate that the item hierarchy may be unstable in a homogeneous laboratory context. Mean Infit and Outfit below 0.70 suggest aggregate overfit, and A20, B38, and B42 had Outfit values just below 0.50. Retaining these items is defensible only provisionally because their content, confirmatory loadings, and corrected item total correlations remained relevant. A complete external Rasch evaluation should examine ordered thresholds, targeting, local dependence, unidimensionality, and differential item functioning across semester groups³⁰⁻³².

The descriptive score profile can still inform local quality improvement without imposing unsupported quality categories. Resource access and management had the lowest percentage of the theoretical maximum, although the difference from other dimensions was small. This domain concerns access, scheduling, storage, renewal, and management of institutional resources. Recent *Healthy Tadulako Journal* evidence similarly shows that structured program evaluation, equitable resource availability, and adequate facilities are central to service performance and should be assessed as operational systems rather than as isolated assets^{38,41,42}.

Learning resources and simulation support also warrant attention because physical equipment alone does not ensure effective learning. Evidence from simulation research emphasizes facilitation, feedback, fidelity, and accessible learning design, while recent *Healthy Tadulako Journal* studies show that video, booklet, and simulation based educational resources can support knowledge or practical skill development in different settings. These findings support retaining learning resource domains while testing whether their items provide information

distinct from the general laboratory quality factor^{13-17,39,40,43}.

Internal consistency was high, with total Cronbach alpha of 0.970 and corrected item total correlations above 0.50. These values support score coherence but do not establish unidimensionality or validity, and a very high alpha can arise from scale length or redundant content. McDonald omega and interitem correlation diagnostics could not be reconstructed from the summary output alone and should be included in the next validation cycle. Strengths of the present study include a clearly mapped construct, five expert validators, 446 student respondents, and complementary psychometric approaches. Limitations include a single institution, purposive sampling, an imbalanced semester distribution, absence of an auditable recruitment denominator, use of the same sample for exploratory and confirmatory analyses, incomplete preserved analytic settings for ordinal factor analysis, moderate Rasch item reliability, and absence of test retest, invariance, criterion validity, and responsiveness evidence³³⁻³⁷.

Future research should externally validate the instrument across multiple midwifery institutions with more balanced semester groups and greater variation in laboratory conditions. A prespecified split sample or independent confirmatory sample should be used, together with polychoric correlations and an ordinal estimator where appropriate. Reliability assessment should include McDonald omega and test retest stability, while structural analysis should compare correlated factor, higher order, and bifactor models. Rasch evaluation should report category thresholds, person item targeting, separation, local dependence, unidimensionality, and differential item functioning. Linking scores with objective laboratory audits and

competency indicators would also strengthen criterion and practical validity.

Conclusion

This study developed a 44 item instrument integrating six service quality dimensions and five resource adequacy dimensions for midwifery laboratory evaluation. The available data provide promising internal evidence for content representation, sampling adequacy, preliminary structural fit, respondent differentiation, and score consistency, but they do not establish definitive validity or broad generalizability. The six factor exploratory solution, CFI and TLI below 0.90, moderate Rasch item reliability, aggregate overfit tendency, and use of one institutional sample justify cautious interpretation. The instrument can be used provisionally for local internal evaluation, while independent external validation with complete ordinal factor analysis, extended Rasch diagnostics, omega, test retest assessment, measurement invariance, and objective laboratory indicators is required before wider use.

Acknowledgment

The authors thank Poltekkes Kemenkes Jakarta I, the Midwifery Laboratory management, the expert validators, and all participating midwifery students for their contribution to instrument development and field testing. This research was supported by a research grant administered through Simlitabkes. The authors declare no conflicts of interest.

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Conflict of Interest Statement

The author(s) declare no commercial, financial, or personal conflicts of interest related to this research. All authors approved the final manuscript and consented to its publication in Healthy Tadulako Journal.

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