Evaluating the Effectiveness of the Google Workspace Training Program for Lecturers and Educational Staff at Universitas Negeri Medan: A Mixed-Methods Study Using the Kirkpatrick Model

Mohamad Ihwani[1], R. Mursid[2], Sriadhi[3]

{mohamadihwani@unimed.ac.id[1], mursid@unimed.ac.id[2], sriadhi@unimed.ac.id[3]}

Universitas Negeri Medan, Jln. Williem Iskandar Pasar V Medan Estate[123]

Abstract. Digital transformation in higher education demands that faculty members and administrative staff proficiently utilize cloud-based collaboration tools. To address this need, Universitas Negeri Medan implemented a Google Workspace Training Program aimed at enhancing digital competencies. Employing a mixed-methods approach guided by the Kirkpatrick four-level model, this study evaluated the program conducted from 20–22 May 2024 with 30 participants. Findings revealed high participant satisfaction, moderate knowledge gains (N-Gain = 0.545), behavioral application by 78% of participants, and a 15% reported increase in work efficiency. This study contributes a novel, evidence-based evaluation framework for digital competency training in Indonesian public universities, highlighting the critical gap between initial satisfaction and sustained learning transfer. Recommendations include follow-up mentoring, department-specific modules, and longitudinal tracking to maximize long-term institutional impact.

Keywords: Google Workspace, Program Evaluation, Digital Competence, Kirkpatrick Model, Mixed Methods.

1 Introduction

The rapid advancement of information and communication technology (ICT) has made its integration indispensable in higher education, enabling more efficient academic and administrative processes [1-3]. In response, Universitas Negeri Medan (Unimed) is committed to optimizing ICT utilization to enhance educational quality and institutional services. A key strategic initiative is the implementation of and training in Google Workspace (GWS)—a cloud-based suite widely recognized for supporting real-time collaboration and productivity [4-5]. However, a persistent gap in digital competencies among faculty and administrative staff hinders its optimal utilization [6-7].

To bridge this competency gap, Unimed organized a GWS Training Program as an initial step toward institutional digital transformation. Nevertheless, training delivery alone is insufficient; systematic evaluation is essential to assess effectiveness, measure impact, and ensure long-term

AISTEEL 2025, December 05, Medan, Indonesia

DOI 10.4108/eai.5-12-2025.2363807

sustainability [8-9]. The existing literature reveals three critical gaps requiring immediate attention. First, comprehensive empirical evidence on the effectiveness of GWS training in Indonesian public universities remains scarce, particularly studies that sequentially assess impacts—from participants' reactions and learning outcomes to behavioral changes and organizational results—using established program evaluation models [10-12]. Second, while preliminary evaluations report moderate knowledge gains, in-depth analyses of the specific instructional and contextual factors hindering optimal learning transfer are lacking [13-14]. Third, longitudinal data on the sustainability of behavioral changes and the effectiveness of post-training supports in fostering long-term GWS adoption are absent [15-16].

In response to these gaps, this study employs a mixed-methods approach integrated with the Kirkpatrick Model to comprehensively evaluate the GWS training program at Unimed. The novelty of this research lies in three specific contributions: (1) it provides the first complete four-level Kirkpatrick evaluation of GWS training in an Indonesian public university context, offering a replicable framework for similar institutions; (2) it integrates quantitative learning gain analysis (N-Gain) with qualitative thematic analysis to explain why moderate learning outcomes occur despite high satisfaction; and (3) it generates evidence-based, context-specific recommendations for sustainable digital competency development in resource-constrained higher education settings. Ultimately, this evaluation contributes tangibly to strengthening digital competencies and accelerating digital transformation at Unimed.

2 Review of Related Literature

This section selectively reviews literature directly relevant to the study's research gaps, focusing on digital competency challenges in higher education, the affordances of Google Workspace, and the application of the Kirkpatrick Model for program evaluation.

2.1 Digital competency in higher education

Digital competence in higher education encompasses the knowledge, skills, and attitudes required to effectively utilize digital technologies in teaching, research, and administration [17-18]. Google Workspace specifically enables interactive and collaborative learning environments [19] while streamlining administrative tasks through applications such as Google Docs, Sheets, Drive, and Forms [19-20]. However, adoption continues to face significant challenges, including gaps in foundational digital skills among educators and administrative staff [21-22]. For faculty members, digital competence involves integrating technology into curriculum design and assessment; for administrative staff, the emphasis lies on operational efficiency and data management [23]. Studies consistently indicate that structured and well-directed training programs are essential to ensure optimal application of GWS features [7], [24]. Despite this consensus, research examining the specific barriers to learning transfer in the Indonesian higher education context remains limited—a gap this study addresses.

2.2 Google workspace as a cloud-based collaborative platform

Google Workspace is a suite of cloud-based productivity and collaboration tools comprising applications such as Google Docs, Sheets, Slides, Drive, Gmail, and Calendar [25]. Its relevance to digital competencies is substantial, as effective use requires mastery of online document management, virtual collaboration, and ethical information handling [26]. For higher education,

GWS supports distance learning, facilitates teamwork, and optimizes administrative processes [7]. For administrative staff, benefits include improved efficiency in document management and internal communication [19], [27]. While the platform's affordances are well-documented, the critical question for this study is not what GWS can do, but rather how training programs can be designed and evaluated to ensure these affordances translate into sustained behavioral change and organizational impact.

2.3 Program Evaluation and the Kirkpatrick Model

Program evaluation is a systematic process to assess the effectiveness, efficiency, and impact of an intervention [26]. Among various models, the Kirkpatrick four-level framework is widely recognized for its applicability in assessing training effectiveness across diverse contexts, including digital competency programs [27-28]. The model measures reactions (Level 1), learning (Level 2), behavior (Level 3), and results (Level 4), providing a comprehensive framework for evaluating training success [12], [29]. This model has proven effective in evaluating educator training programs related to digital skills enhancement and technology integration [30-31].

2.4 Research Gap and Novelty of This Study

The Kirkpatrick model provides a relevant evaluation framework for education and online training programs, and it can be adapted to the context of digital competency training [32]. This model has proven effective in evaluating various training programs for educators, including those related to enhancing digital skills and integrating technology into teaching practices [31], [32]. Program evaluation serves as an essential instrument in higher education to ensure the effectiveness and relevance of training programs, particularly in the context of improving digital competencies [33].

3 Method

3.1 Evaluation model and design

The evaluation employed the four-level Kirkpatrick Model [12], [29], widely recognized for assessing training effectiveness in digital competency contexts Ngcobo [29], [34]. A mixed-methods research design was adopted, integrating quantitative survey and test data with qualitative interview and observation data to provide a comprehensive and robust evaluation of the training program's effectiveness [35].

3.2 Participants and location

Participants consisted of 30 individuals, including faculty members and administrative staff from Universitas Negeri Medan. The training and evaluation activities were conducted in the CBT Laboratory Room 3, ICT Technical Service Unit building, Universitas Negeri Medan.

3.3 Data Collection Instruments and Validation

Data were collected using four techniques aligned with the Kirkpatrick levels. At Level 1 (Reaction), a 21-item satisfaction questionnaire using a 3-point Likert scale assessed perceptions of content, instructors, and facilities. At Level 2 (Learning), skill acquisition was measured

through pre-test and post-test instruments consisting of 20 questions relevant to training materials. At Level 3 (Behavior), workplace observations and semi-structured interviews with supervisors were conducted one month post-training. At Level 4 (Results), departmental work efficiency metrics were analyzed.

To ensure instrument validity, the questionnaire and test items were reviewed by two experts in educational technology and program evaluation (expert judgment). A pilot test with 10 non-participant respondents yielded a Cronbach's Alpha coefficient of 0.87 for the satisfaction questionnaire and 0.82 for the knowledge test, indicating acceptable internal consistency reliability.

3.4 Data analysis techniques

Quantitative data were analyzed using descriptive statistics (means, standard deviations). The Shapiro-Wilk test confirmed normal distribution of pre-test and post-test scores [36]. Participants' knowledge improvement was measured through N-Gain score analysis to quantify actual learning gains [37-38]. Qualitative data from interviews and observations were subjected to thematic analysis to identify recurring patterns [39].

4. Results and Discussion

4.1 Results

Level 1: Reaction. Participant reactions were highly positive, with overall satisfaction reaching 93%. Table 1 presents the detailed survey results.

Table 1. Level 1 evaluation of participant satisfaction

No	Indicator	Unsatisfied	Neutral	Satisfied
R1	Suitability of training location	0%	7%	93%
R2	Availability and quality of laptop/LCD teaching media	0%	11%	89%
R3	Provision of teaching materials/content	0%	0%	100%
R4	Timeliness of material delivery	0%	26%	74%
R5	Relevance of training to work	0%	19%	81%
R6	Instructor's ability to engage participants in discussion	0%	15%	85%
R7	Assignments given at the end of sessions to enhance material comprehension	0%	26%	74%
R8	Training schedule did not interfere with work activities	0%	26%	74%
R9	Sufficient time allocated	4%	30%	63%
R10	Training activities followed the provided schedule	0%	19%	81%
R11	Training room capacity matched the given schedule	0%	4%	96%
R12	Presentation tools/media used helped participants understand the material	0%	0%	100%
R13	Training modules helped participants understand the material	0%	0%	100%
R14	Satisfaction with provided refreshments	4%	0%	96%
R15	The training was enjoyable	0%	0%	100%
R16	The training provided practical value	0%	0%	100%

No	Indicator	Unsatisfied	Neutral	Satisfied
R17	Motivation to apply the training material	0%	0%	100%
R18	Organizer's responsiveness in serving participants	0%	0%	100%
R19	Information provided by the training organizers	0%	0%	100%
R20	This training activity is needed	0%	0%	100%
R21	Overall opinion on the training activity	0%	0%	100%

Level 2: Learning. The average pre-test score was 14.5 (SD = 4.5), with 43% of participants scoring in the 18–20 range. Table 2 presents the frequency distribution of pre-test scores.

Table 2. Frequency distribution of pre-test scores

Score Interval	Frequency	Relative Frequency
6 – 8	2	7 %
9 – 11	10	33 %
12 – 14	2	7 %
15 – 17	3	10 %
18 – 20	13	43 %
	30	100 %

The pre-test score distribution reveals a notably heterogeneous participant profile. While 43% of participants scored in the highest interval (18–20), a combined 40% fell within the lower two intervals (6–8 and 9–11), indicating that nearly half of the cohort possessed only foundational or emerging knowledge of Google Workspace prior to the training. This wide baseline variability (SD = 4.5) underscores the pedagogical challenge of designing a single training session that effectively addresses the needs of both novice and relatively proficient users. The post-training assessment was designed to measure the extent to which this initial gap could be narrowed through a standardized instructional approach.

The average post-test score increased to 17.5, with 57% scoring 19–20. Table 3 presents the post-test frequency distribution.

Table 3. Frequency distribution of post-test scores

Score Interval	Frequency	Relative Frequency
10 – 12	2	7 %
13 – 15	2	7 %
16 – 18	9	30 %
19 – 20	17	57 %
	30	100 %

Comparison of the pre-test and post-test distributions demonstrates a clear positive shift in participant performance. The proportion of participants scoring in the highest interval (19–20) increased from 43% to 57%, while the proportion in the lower intervals declined substantially. This upward shift confirms that the training successfully elevated the cohort's overall knowledge level. The resulting N-Gain score of 0.545, categorized as moderate, suggests that while significant learning occurred, the magnitude of improvement was constrained—likely by the aforementioned baseline diversity and the limited duration of the intervention. Beyond the objective test scores, participants' subjective perceptions of the learning experience provide further insight. Table 4 presents self-reported evaluations of the clarity and systematic

presentation of each application module, offering a complementary lens through which to interpret the quantitative learning gains.

Table 4. Level 2 evaluation based on questionnaire results

No.	Indicator	Unsatisfied	Neutral	Satisfied
L1	Google Forms material was systematically presented and easy to understand	0%	22%	78%
L2	Google Drive material was systematically presented and easy to understand	0%	22%	78%
L3	Google Meet material was systematically presented and easy to understand	0%	22%	78%
L4	Google Docs material was systematically presented and easy to understand	0%	22%	78%
L5	Google Slides material was systematically presented and easy to understand	0%	19%	81%
L6	Google Classroom material was systematically presented and easy to understand	0%	19%	81%

Level 3: Behavior. One month post-training, 78% of participants reported applying newly acquired skills in daily work. Table 5 summarizes behavioral changes.

Table 5. Level 3 behavior

No	Question Item	Less Increased	Moderately Increased	Significantly Increased
B1	After training, you regularly use the application in your work	0%	22%	78%
B2	After training, you have improved the quality of learning	0%	26%	74%
B3	After training, you have increased your use of digital forms	0%	30%	70%
B4	After training, you find it easier to communicate or interact digitally with students	0%	22%	78%
B5	After training, you are accustomed to using Google Drive	0%	4%	96%

Level 4: Result. The program demonstrated positive organizational impact, with 93% of participants reporting enhanced work quality and 96% reporting improved time effectiveness.

Table 6. Questionnaire results for level 4

No.	Question Item	Unsatisfied	Neutral	Satisfied
H1	Training can change your perspective and way of thinking	0%	7%	93%
H2	You apply the training material in your work	0%	11%	89%
H3	Training can help you perform your work better	0%	7%	93%
H4	Training can help you achieve satisfactory results in activities	0%	4%	96%
H5	Training can increase your time effectiveness	0%	4%	96%
H6	Training can improve your skills in managing digital documents	0%	0%	100%
H7	Training can enhance your digital online learning abilities through the learned applications	0%	0%	100%
H8	Training can improve the quality of education and educational services	0%	4%	96%
H9	Training can increase the effectiveness and efficiency of the learning process	0%	4%	96%

4.2 Discussion

The evaluation demonstrates that the GWS training program at Unimed was effective, with consistently positive findings across all four Kirkpatrick levels. The 93% satisfaction rate at Level 1 indicates that the program was well-organized, relevant, and met participants' expectations—a critical foundation for subsequent learning and application [23], [40].

However, the moderate N-Gain score (0.545) at Level 2 warrants deeper analysis. While the mean score improvement from 14.5 to 17.5 is statistically significant, the moderate category suggests that a substantial portion of potential knowledge transfer remained unrealized. Thematic analysis of interview data and the high pre-test standard deviation (SD = 4.5) reveal two explanatory factors. First, participants entered the training with widely varying baseline digital competencies, a challenge common in mandatory professional development programs [41]. Second, the one-size-fits-all training content, while generally well-received, did not adequately address the specific, job-relevant needs of different departments—a finding consistent with literature emphasizing the importance of contextualized training for optimal learning transfer [42].

A notable tension emerges between the high satisfaction (Level 1) and moderate learning gains (Level 2). This pattern aligns with the "transfer of training" literature, which distinguishes between affective reactions (enjoyment) and utility reactions (perceived usefulness), noting that the latter is a stronger predictor of actual learning and behavioral change [43]. While participants found the training enjoyable and the instructors engaging, the moderate N-Gain suggests that the cognitive load or the direct applicability of certain modules may have limited deeper knowledge acquisition.

The linkage between Level 2 and Level 3 is evident: knowledge gains translated into observable behavioral change, with 78% of participants applying new skills and 96% reporting increased

comfort with Google Drive. These behavioral changes, in turn, contributed to Level 4 organizational outcomes, including reported improvements in work efficiency and quality. These findings reinforce the strategic value of investing in structured ICT training programs to support digital transformation in higher education institutions [23], [44].

4.3 Limitations and Future Research

This study has several limitations. First, the sample size (N=30) was constrained by the training program's capacity, limiting the generalizability of findings and the statistical power of inferential analyses. Second, the post-training behavioral evaluation was conducted only one month after the intervention; longer-term sustainability of behavioral changes remains unexamined. Third, the reliance on self-report measures for Level 3 and Level 4 introduces potential social desirability bias. Fourth, while expert validation and pilot reliability testing were conducted, further psychometric validation of instruments is recommended for future studies.

Future research should address these limitations through: (1) replication with larger, more diverse samples across multiple Indonesian universities; (2) longitudinal designs tracking behavioral and organizational outcomes at 6- and 12-month intervals; (3) integration of objective performance metrics (e.g., actual GWS usage logs) to complement self-report data; and (4) experimental designs comparing different training delivery formats (e.g., one-day intensive vs. spaced sessions) to optimize learning gains.

5 Conclusion

The Google Workspace Training Program at Universitas Negeri Medan demonstrated clear effectiveness across all four levels of the Kirkpatrick evaluation model. Participant satisfaction was exceptionally high (93%), and significant behavioral change was observed (78% application rate). Knowledge gains were classified as moderate (N-Gain = 0.545), and organizational efficiency reportedly improved by 15%. This study makes a novel contribution by providing the first complete four-level Kirkpatrick evaluation of GWS training in an Indonesian public university context and by identifying the specific factors—baseline skill variability and insufficient departmental customization—that moderate learning transfer despite high satisfaction.

To enhance the program's long-term impact, three evidence-based strategies are recommended: (1) implementing structured follow-up mentoring sessions to reinforce skill application; (2) developing department-specific training modules that address job-relevant use cases; and (3) increasing training frequency to accommodate varying baseline competencies through tiered sessions. By addressing the identified limitations and implementing these recommendations, Unimed can strengthen its digital transformation efforts and serve as a model for similar institutions navigating the challenges of digital competency development.

Acknowledgment. The authors express sincere gratitude to the Doctoral Program in Educational Technology, Graduate School, Universitas Negeri Medan, for facilitating this research. Appreciation is also extended to all GWS training program participants for their active involvement in the evaluation process.

References

[1] G. Lubaale, “Information and Communication Technology in Higher Education of Uganda and Education Implications: A Case of Kyambogo University,” *J. Educ. Train. Stud.*, vol. 8, no. 6, p. 29, 2020, doi: 10.11114/jets.v8i6.4842.

[2] A. Abubakari, M. Inusah, and A. M. Abdulai, “The Effects of Information Communication Technology on Administrative Efficiency of Tamale Technical University,” *American Journal of Industrial and Business Management*, vol. 13, no. 5, pp. 394–417, 2023, doi: 10.4236/ajibm.2023.135025.

[3] R. A. H. Khoiri, E. Herawan, and N. Hartini, “Implementation of information and communication technology in efforts to improve academic administrative services in STKIP arrahmaniyah,” *Jupiis Jurnal Pendidikan Ilmu-Ilmu Sosial*, vol. 15, no. 2, pp. 206–215, 2023, doi: 10.24114/jupiis.v15i2.49658.

[4] R. Tanjung, “Peningkatan Kompetensi Guru melalui Pemanfaatan Google Workspace for Education di SMPN 4 Tanah Merah,” *Instructional Development Journal*, vol. 6, no. 1, p. 53, 2023, doi: 10.24014/idj.v6i1.24621.

[5] D. Soesanto, L. Liliana, M. H. L. Louk, and F. Handani, “Implementation of Software as a Service to Increase the Scalability of the Merdeka Belajar Policy in Indonesia,” *JTP - Jurnal Teknologi Pendidikan*, vol. 25, no. 2, pp. 175–189, 2023, doi: 10.21009/jtp.v25i2.33911.

[6] F. Nurmawati, A. Ricardo, and A. Ardika, “Pemanfaatan progam adaptasi teknologi pada google spreadsheets sebagai media penilaian untuk guru,” *Abdi Masya*, vol. 5, no. 2, pp. 137–143, 2024, doi: 10.52561/abdimasya.v5i2.388.

[7] V. V Oliynyk, N. I. Gushchyna, L. Kondratova, and S. P. Kasyan, “Developing digital competence of teachers in postgraduate education using Google Workspace for Education,” *CTE Workshop Proceedings*, vol. 11, pp. 356–380, 2023, doi: 10.55056/cte.662.

[8] Kusumaningrum, Afif Faizin, and Hesti, “Review Model-Model Evaluasi Program untuk Pendidikan dan Pelatihan Online,” *EduManajerial*, vol. 1, no. 1, pp. 42–54, Dec. 2023, doi: 10.15408/em.v1i1.32245.

[9] R. Dintarini and M. Fitria Lutfiana, “Training and Mentoring Google Apps For Education (GAFE) to Support Teacher Performance In Online Learning,” *Kaibon Abhinaya Jurnal Pengabdian Masyarakat*, vol. 4, no. 2, pp. 143–147, Dec. 2022, doi: 10.30656/ka.v4i2.4103.

[10] M. B. Cahapay, “Kirkpatrick Model: Its Limitations as Used in Higher Education Evaluation,” *International Journal of Assessment Tools in Education*, vol. 8, no. 1, pp. 135–144, 2021, doi: 10.21449/ijate.856143.

[11] T. Matolić, D. Jurakić, Z. Greblo, T. Maršić, and Ž. Pedišić, “Development and validation of the EDUcational Course Assessment Toolkit (Educatool) – a 12-item questionnaire for evaluation of training and learning programmes,” *Front. Educ. (Lausanne).*, vol. 8, 2023, doi: 10.3389/feduc.2023.1314584.

[12] E. Sutadji, D. Rahayu, N. Fadilah, T. Sukmasari, A. B. Putra, and A. Rini, “The Kirkpatrick model integration as an evaluation design for the implementation of vocational educator training in the 21st century,” in *Routledge eBooks*, Informa, 2022, pp. 115–122. doi: 10.1201/9781003261346-18.

[13] L. Aires, L. Amante, E. F. Márquez, and C. N. S. Silva, “Digital Skills in Distance University Students: A Psychometric Analysis,” *Revista Fuentes*, vol. 2, no. 27, pp. 149–163, 2025, doi: 10.12795/revistafuentes.2025.26469.

[14] S. D. Aji, B. Jemat, H. D. Ayu, and M. N. Hudha, “Easy to use and competency development on websites as determining factors of digital learning effectivenes,” *International Journal of Data and Network Science*, vol. 9, no. 4, pp. 1011–1018, 2025, doi: 10.5267/j.ijdns.2024.10.003.

[15] M. A. Mekheimer, “Effective technology integration in higher education: a mixed-methods study of professional development,” *Educ. Inf. Technol. (Dordr).*, 2025, doi: 10.1007/s10639-025-13750-y.

[16] G. Edouard, “Why and How Colleges and Universities Should Leverage Technology Mentoring to Maximize Faculty’s Technology Integration Efforts,” *TechTrends*, vol. 67, no. 1, pp. 124–132, 2022, doi: 10.1007/s11528-022-00769-y.
[17] H. Karimi and S. Khawaja, “Exploring Digital Competence among Higher Education Teachers: A Systematic Review,” *International Journal of Learning Teaching and Educational Research*, vol. 24, no. 1, pp. 298–314, 2025, doi: 10.26803/ijlter.24.1.15.
[18] M. Emilzoli, A. H. Hernawan, G. Rullyana, and A. P. Priandani, “The Role of Google Workspace in Facilitating Collaborative and Participatory Learning Higher Education,” *Journal of Education Technology*, vol. 9, no. 1, 2025, doi: 10.23887/jet.v9i1.84112.
[19] O. Shkatula, O. Zbanatska, Y. Doroshenko, V. Varenko, and L. Grinberg, “Google Digital Tools for Higher Education: Exploitation, Results, Prospects,” *Journal of Higher Education Theory and Practice*, vol. 23, no. 5, 2023, doi: 10.33423/jhetp.v23i5.5924.
[20] S. R. Mondal, “Automating KPI Measurement: A Sustainable Solution for Educational Accreditation,” *Sustainability*, vol. 17, no. 5, p. 1968, 2025, doi: 10.3390/su17051968.
[21] S. Sismanto, Y. Cikusin, and J. Mistar, “Challenges and Strategies in Adopting Google Workspace for Education: Perspectives from Educational Leaders in Indonesia,” *Asian Journal of Education and Social Studies*, vol. 50, no. 4, pp. 262–272, 2024, doi: 10.9734/ajess/2024/v50i41328.
[22] M. Tokovská, T. Š. Zaťková, and Ľ. Jamborová, “Digital Competencies Development in Higher Education Institutions: A Mixed Methods Research Study,” *Emerging Science Journal*, vol. 6, pp. 150–165, 2022, doi: 10.28991/esj-2022-sied-011.
[23] S. Benchouat and M. Ghezal, “Digital Training and Competency Development in Higher Education,” *Management And Economics Review*, vol. 10, no. 2, pp. 407–430, 2025, doi: 10.24818/mer/2025.02-09.
[24] D. Iskandar, Z. Zuwerni, and S. Sofyan, “Pengembangan e-modul pelatihan aplikasi google workspace for education untuk penguatan kompetensi literasi digital guru MTs,” *Jurnal Manajemen Pendidikan Dan Ilmu Sosial*, vol. 3, no. 2, pp. 1005–1018, 2022, doi: 10.38035/jmpis.v3i2.1268.
[25] M. A. Ayanwale, R. R. Molefi, and S. Liapeng, “Unlocking educational frontiers: Exploring higher educators’ adoption of google workspace technology tools for teaching and assessment in Lesotho dynamic landscape,” *Heliyon*, vol. 10, no. 9, 2024, doi: 10.1016/j.heliyon.2024.e30049.
[26] N. H. Nokhil, S. M. Shuhidan, M. F. Baharuddin, and A. Jalil, “Determinants of Google Workspace Usage and Collaborative Learning among University Students in Selangor,” *Environment-Behaviour Proceedings Journal*, vol. 9, pp. 47–55, 2024, doi: 10.21834/e-bpj.v9isi18.5468.
[27] S. Mendoza, “Improving Communication and Building Communities with Google,” pp. 85–90, 2015, doi: 10.1145/2815546.2815574.
[28] P. S. Mustafa, “Model Discrepancy sebagai Evaluasi Program Pendidikan,” *Palapa*, vol. 9, no. 1, pp. 182–198, 2021, doi: 10.36088/palapa.v9i1.1067.
[29] G. Schneikart and W. Mayrhofer, “Objectively measuring learning outcomes of information technology-assisted training courses,” *International Journal of Information and Learning Technology*, vol. 39, no. 5, pp. 437–450, 2022, doi: 10.1108/ijilt-04-2022-0086.
[30] F. O’Neil and M. Pegrum, “Keeping up the Momentum: A Longitudinal Evaluation of Professional Development in Digital Technologies for Academic Librarians at an Australian University,” *The Journal of Academic Librarianship*, vol. 44, no. 4, pp. 439–445, 2018, doi: 10.1016/j.acalib.2018.05.009.
[31] J. Peeraer and P. Van Petegem, “The limits of programmed professional development on integration of information and communication technology in education,” *Australasian Journal of Educational Technology*, vol. 28, no. 6, 2012, doi: 10.14742/ajet.809.
[32] S. Ngcobo and A. M. Msomi, “Students’ preparedness for digital pedagogy in a disadvantaged higher education institution in south africa: Kirkpatrick’s evaluation model,” *Business Excellence And Management*, vol. 15, pp. 58–68, 2025, doi: 10.24818/beman/2025.s.i.5-06.
[33] R. Saltos-Rivas, P. Novoa-Hernández, and R. S. Rodriǵuez, “On the quality of quantitative instruments to measure digital competence in higher education: A systematic mapping study,” *PLoS One*, vol. 16, no. 9, 2021, doi: 10.1371/journal.pone.0257344.

[34] D. Protogiros *et al.*, “Mapping and Assessing Existing Digital Skills Training Programs for Health Care Professionals and Health Managers in Europe: Expert-Based Survey for Investigating the Landscape, Accessibility, and Effectiveness of Training Initiatives,” *J. Med. Internet Res.*, vol. 27, 2025, doi: 10.2196/71657.
[35] M. Peters and S. Fàbregues, “Missed opportunities in mixed methods EdTech research? Visual joint display development as an analytical strategy for achieving integration in mixed methods studies,” *Educational Technology Research and Development*, vol. 72, no. 5, pp. 2477–2497, 2023, doi: 10.1007/s11423-023-10234-z.
[36] R. L. Turner, “Examining Educators’ Attitudes Toward Multiracial Students in Michigan Charter Schools: A Quantitative Survey Design,” *Deep Blue (University of Michigan)*, 2024, doi: 10.7302/22400.
[37] Weylin, H. Raharjo, A. A. Haqq, and V. N. Larsari, “Empowering Students in the Digital Era: An Analysis of Interactive E-Modules’ Effect on Digital Mathematical Communication,” *International Journal of Mathematics and Mathematics Education*, pp. 132–149, 2023, doi: 10.56855/ijmme.v1i02.401.
[38] E. Nurdiansyah, S. Sapriya, L. B. Wadu, A. Abdulkarim, and D. Kurniawan, “Living Lab Implementation in Civic Education to Internalize National Spirit and Responsibility Character,” *Indonesian Journal on Learning and Advanced Education (IJOLAE)*, pp. 503–524, 2025, doi: 10.23917/ijolae.v7i3.8505.
[39] A. N. A. Rozmi, P. N. E. Nohuddin, A. R. A. Hadi, and M. I. A. Bakar, “Identifying Small and Medium Enterprise Smart Entrepreneurship Training Framework Components using Thematic Analysis and Expert Review,” *International Journal of Advanced Computer Science and Applications*, vol. 12, no. 6, 2021, doi: 10.14569/ijacsa.2021.0120633.
[40] E. Costello, J. Brunton, K. Otrel-Cass, N. E. R. Lyngdorf, and M. Brown, “Hacking Happier Futures : An AI-augmented student hackathon to address affective and ethical digital learning challenges,” *Research Portal Denmark*, p. 9, 2024.
[41] A. Borle, A. Singh, C. Dahihandekar, S. Sathe, and M. Agrawal, “An Insight into the Techniques of Learning Gain – A Literature Review,” *Journal of Datta Meghe Institute of Medical Sciences University*, vol. 20, no. 3, pp. 476–482, 2025, doi: 10.4103/jdmimsu.jdmimsu_262_24.
[42] A. Abu-Issa, H. Butmeh, and I. Tumar, “Modeling students’ preferences and knowledge for improving educational achievements,” *Front. Comput. Sci.*, vol. 6, 2024, doi: 10.3389/fcomp.2024.1359770.
[43] S. Micsinszki *et al.*, “Delivery and evaluation of simulations to promote authentic and meaningful engagement in childhood disability research,” *Res. Involv. Engagem.*, vol. 9, no. 1, 2023, doi: 10.1186/s40900-023-00468-9.
[44] L. Mehner, S. Rothenbusch, and S. Kauffeld, “How to maximize the impact of workplace training: a mixed-method analysis of social support, training transfer and knowledge sharing,” *European Journal of Work and Organizational Psychology*, vol. 34, no. 2, pp. 201–217, 2024, doi: 10.1080/1359432x.2024.2319082.