FROM DIGITAL ACCESS TO PERCEIVED ACADEMIC VALUE: A DOCUMENTARY CASE SYNTHESIS

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ABSTRACT
Digital access does not automatically create academic value when evaluative skills, connectivity, assessment, and attention are uneven. This study examined how institutional policy, curriculum integration, student digital practices, and implementation constraints shaped the perceived learning value of digital literacy in Grade XI at SMA Negeri 1 Amurang, Indonesia. Because the available record did not include raw transcripts, participant counts, fieldwork dates, or numerical achievement data, the article is presented as a documentary qualitative case synthesis rather than a reanalysis of primary data. The synthesis draws on the study report's summaries of interviews with students, teachers, and school leaders, classroom and laboratory observations, curricula, lesson plans, academic records, and student digital products. Reported evidence indicates that ethical-use policies, teacher development, broad in-school access, and a recurring 30-minute literacy period supported implementation. Cross-subject content creation and use of Google services, AI tools, and Canva were perceived to strengthen conceptual clarification, collaboration, and assignment quality. These benefits were constrained by unequal home access, unstable networks, distraction, and inconsistent assessment criteria. No causal effect on grades was estimated. The study offers a provisional institutional-curricular implementation heuristic in which policy and infrastructure enable opportunities, curriculum and pedagogy convert them into purposeful practice, and assessment, ethics, self-regulation, family support, and access conditions shape perceived academic value. Future multi-site research should test these relationships with performance-based digital-literacy measures and longitudinal achievement indicators.

Keywords: Academic value, Digital equity, Digital literacy, Educational technology, Secondary education

INTRODUCTION

In the past decade, educational systems have moved from treating digital technology as an optional instructional supplement to regarding digital competence as a condition for participation in learning, work, citizenship, and social life. This transition has accelerated the use of search engines, cloud platforms, multimedia-authoring tools, learning-management systems, and, more recently, generative artificial-intelligence applications in secondary education. Yet the educational significance of this transition lies less in the presence of devices than in students' capacity to locate, interpret, evaluate, create, communicate, and act on information in responsible ways. Digital literacy is therefore a multidimensional competence that includes operational skill, information judgment, communication, content creation, safety, ethics, and strategic problem solving rather than a narrow ability to operate hardware (Falloon, 2020; Ng, 2012; Spante et al., 2018; van Laar et al., 2017).

International research consistently shows that young people's frequent exposure to technology should not be confused with advanced digital literacy. The 'digital native' assumption is particularly problematic because students may be fluent in entertainment-oriented applications while remaining weak in source evaluation, advanced search, data interpretation, privacy management, or the purposeful creation of academic products (Gui & Argentin, 2011; Helsper & Eynon, 2010; Ng, 2012). Performance-based studies among secondary-school students have identified substantial variation in operational, information-processing, and evaluative skills, including within the same school or age group (Claro et al., 2012; Hatlevik & Christophersen, 2013; Hatlevik et al., 2015). National evidence on civic online reasoning likewise indicates that many students struggle to judge the credibility and provenance of online information, despite their confidence in using digital media (Breakstone et al., 2021).

Longitudinal evidence further indicates that digital literacy develops unevenly across school years and is shaped by the kinds of digital activities in which students participate, reinforcing the need to distinguish frequency of use from quality of use (Lan et al., 2026).

The relationship between digital literacy and academic achievement is also more complex than a direct technology-effect proposition. Meta-analytic evidence suggests a positive association between information-and-communication-technology literacy and academic outcomes, but the size and consistency of the relationship depend on learner characteristics, educational level, measurement strategy, instructional purpose, and the social context of access (Lei et al., 2021; Li et al., 2025). Digital competence can support achievement by improving information retrieval, self-regulated learning, problem solving, collaboration, and the quality of learning artifacts. These mechanisms are reinforced when students possess digital self-efficacy and use technology strategically for learning rather than merely frequently (Pagani et al., 2016; Prior et al., 2016; Rohatgi et al., 2016). Conversely, unstructured use, multitasking, and excessive smartphone engagement can interfere with concentration and reduce academic performance (Amez & Baert, 2020; Sana et al., 2013). In secondary mathematics and science, a context-specific meta-analysis likewise found that digital tools can improve learning when they are linked to instructional design and teacher preparation rather than introduced as stand-alone resources (Hillmayr et al., 2020).

The practical challenge for schools is therefore to convert digital access into academic value. This conversion requires alignment across infrastructure, leadership, curriculum, pedagogy, teacher competence, assessment, student agency, and family support. Teacher digital competence is a critical part of this ecology because students benefit when educators can select technologies in relation to learning objectives, design authentic tasks, model ethical and critical information practices, and evaluate digital work consistently (Falloon, 2020; Instefjord & Munthe, 2017; Pettersson, 2018). Technology-integration research also suggests that isolated workshops are less effective than sustained professional learning connected to curriculum, modeling, collaboration, and institutional support (Tondeur et al., 2012). A recent systematic review also found substantial variation in how in-service teacher digital competence is operationalized, highlighting the importance of connecting teacher capability to student activity design and assessment (Claro et al., 2024).

Equity adds another layer of urgency. Contemporary digital inequality involves not only whether students have a device or connection, but also the quality, autonomy, continuity, and educational usefulness of access. Socioeconomic and cultural resources influence digital skills, patterns of use, and the outcomes students derive from technology (Scherer & Siddiq, 2019; Scheerder et al., 2017). Upper-secondary research has shown that cultural capital, self-efficacy, and strategic information use are associated with digital competence, while school-level provisions can either mitigate or reproduce these differences (Hatlevik et al., 2015). Recent meta-analytic evidence further indicates that device use may relate differently to academic performance depending on purpose, intensity, and contextual inequality (Wang et al., 2024). Even in highly connected contexts, material differences in device quality, peripherals, maintenance costs, and autonomous access continue to structure the opportunities and outcomes associated with technology use (van Deursen & van Dijk, 2019).

Indonesian secondary-school research has primarily profiled student skill levels or tested subject-specific interventions. Perdana et al. (2019) documented variation in digital-literacy skills among Grade X and XI students in Yogyakarta, while Purwianingsih et al. (2025) reported improvement following a socio-scientific-issues project in a single biology context. These studies demonstrate the relevance of performance and pedagogy but do not explain how leadership, infrastructure, cross-subject curriculum, assessment, home connectivity, and family support operate together. Comparable Global South research likewise shows that institutional

and household resources shape digital competence: multi-province evidence from Zimbabwe identifies infrastructure, safety, and content-creation gaps (Dabengwa et al., 2024), and a large Tanzanian study reports skill differences by school type, location, and parental education (Nkwamah et al., 2026). The Amurang case is theoretically informative because it combines relatively broad in-school access with unequal home connectivity, a recurring digital-literacy period, cross-subject assignments, and inconsistent assessment - a configuration that reveals how digital opportunities are converted, or fail to be converted, into perceived academic value.

SMA Negeri 1 Amurang is treated as a strategically informative case rather than as a statistically representative school. The documented case combines institutional ICT provision, a recurring digital-literacy routine, cross-subject technology use, and persistent home-access and attention constraints. The central problem is not the complete absence of technology but the incomplete conversion of access into critical, ethical, curriculum-relevant practice. Operational fluency can coexist with weak source evaluation, limited strategic use, and vulnerability to distraction.

It remains unclear how several school-level conditions interact in this setting: institutional policy and infrastructure, subject-level curriculum integration, competency and assessment standards, students' actual digital practices, and communication among school leaders, teachers, students, and parents. Prior research commonly isolates one component—for example, access, self-efficacy, teacher competence, or achievement—whereas everyday implementation involves a linked system. A school may provide computers while lacking task-specific guidance; teachers may assign digital products while applying inconsistent rubrics; students may demonstrate creative production at school while facing unstable connections at home; and families may support achievement while lacking sufficient knowledge to supervise digital use.

A general solution is to treat digital literacy as a school-wide learning ecology rather than an individual technical attribute. Such an approach shifts the analytical question from 'Do students use technology?' to 'Under what institutional, curricular, pedagogical, and social conditions does technology use become academically productive?' This formulation also reduces the risk of making an unsupported causal claim. A qualitative case study can identify perceived and documented pathways of contribution, contradictions among stakeholders, and contextual conditions, but it cannot estimate the magnitude of a causal effect without a comparison group, standardized measures, or longitudinal achievement data.

Scientific literature offers several complementary responses to the problem. First, multidimensional frameworks define digital literacy through operational, cognitive, social-emotional, ethical, and creative domains. Ng (2012) emphasizes technical, cognitive, and social-emotional dimensions, while later competence frameworks add information and data literacy, communication, content creation, safety, and problem solving (Falloon, 2020; Redecker, 2017). These frameworks imply that curriculum integration should move beyond device operation toward tasks that require students to evaluate sources, synthesize information, create artifacts, collaborate, protect data, and reflect on consequences.

Second, technology-acceptance and self-efficacy perspectives explain why available technologies may or may not be used productively. Perceived usefulness and ease of use influence adoption (Davis, 1989), while social influence and facilitating conditions shape sustained use within institutions (Venkatesh et al., 2003). In educational settings, self-efficacy links access and intention to actual learning behavior; students who believe they can use digital resources strategically are more likely to persist, regulate their activity, and benefit from online learning (Prior et al., 2016; Rohatgi et al., 2016). These perspectives support interventions that combine accessible infrastructure with guided practice, feedback, and achievable progression.

Third, school-improvement literature on digital competence emphasizes coherent institutional support. Teacher education should connect technology to content, pedagogy,

assessment, and authentic classroom situations (Instefjord & Munthe, 2017; Tondeur et al., 2012). Performance-based assessment is especially important because self-reported confidence can overestimate actual competence. Scenario-based and task-based instruments reveal whether students can search, judge, communicate, and create in context (Claro et al., 2012; Jin et al., 2020; Siddiq et al., 2016). At the same time, schools must address distraction and inequity through explicit routines, ethical-use education, access support, and family partnership rather than relying only on prohibition or device provision (Amez & Baert, 2020; Wang et al., 2024). Research on rubrics shows that scoring consistency and formative value are strengthened when criteria are analytic, exemplars are available, and teachers participate in moderation or rater training (English et al., 2022; Panadero & Jonsson, 2013).

Four linked gaps motivate the study. First, an integration gap remains because association studies commonly isolate access, competence, self-efficacy, or academic outcomes, whereas school implementation connects policy, infrastructure, curriculum, pedagogy, assessment, and home conditions. Meta-analyses establish broad relationships (Lei et al., 2021; Li et al., 2025), but they do not reveal how these components are coordinated within a particular secondary school.

Second, an access-to-use gap persists. Digital-divide research distinguishes physical access from skills, autonomy, purpose, and outcomes (Scheerder et al., 2017; Scherer & Siddiq, 2019), yet school provision can conceal unequal opportunities after school. Third, an assessment gap arises when broad digital-literacy objectives are evaluated through inconsistent subject-level criteria, making progression and fairness difficult to judge (Claro et al., 2012; Siddiq et al., 2016).

Fourth, Indonesian and comparable Global South studies provide valuable student profiles, interventions, and national or regional comparisons, but fewer accounts examine the institutional conversion process within a non-metropolitan public secondary school. The Amurang case is distinctive because the documented combination of a recurring literacy period, cross-subject digital products, broad in-school facilities, uneven home connectivity, and assessment inconsistency permits analysis of how organizational arrangements are translated into student learning experiences.

This article addresses these gaps through a documentary case synthesis and a provisional institutional-curricular implementation heuristic. Its contribution is contextual integration rather than model validation: it links school access, curricular mediation, assessment calibration, student self-regulation, and the home-school boundary in one resource-variable secondary-school setting.

The purpose of this study was to examine how digital literacy was organized, enacted, and represented in the available record as contributing to perceived academic value in Grade XI at SMA Negeri 1 Amurang. Specifically, it sought to describe institutional policies and facilities; analyze curriculum integration, competency expectations, and assessment practices; identify learning-oriented digital practices and their reported contribution to conceptual clarification, participation, and assignment quality; and explain the constraints and support systems shaping implementation.

The novelty lies in a contextual integration of components that are often studied separately. The institutional-curricular heuristic is presented as an implementation tool that explains the proposed conversion from access to purposeful learning practice; it is not a validated causal or predictive model. The working proposition is that perceived academic value is more likely when technology use is curriculum-aligned, cognitively demanding, ethically guided, supported by reliable access, and evaluated through coherent criteria.

The synthesis is bounded to Grade XI learning in one public senior secondary school and to evidence summaries preserved in the available study report. It does not compare schools,

administer a standardized digital-literacy test, reanalyze raw transcripts, quantify grade change, or establish causal impact. Transferability is therefore limited to schools with broadly similar conditions: established in-school ICT access, cross-subject digital assignments, mixed home connectivity, and a need for coherent school-wide assessment. The heuristic may not apply to schools with minimal infrastructure, boarding arrangements, substantially different assessment systems, or consistently high household connectivity.

METHOD

Research Design and Evidentiary Status

The article uses a documentary qualitative case-synthesis design. The bounded case is Grade XI digital-literacy implementation at SMA Negeri 1 Amurang. The original study report described an embedded qualitative case study based on interviews, observations, and documents. However, raw transcripts, observation logs, a participant roster, coding files, and academic-record extracts were not available for this revision. Accordingly, the present manuscript synthesizes the documented case rather than claiming an independent reanalysis of primary data. The term phenomenological sensitivity has been removed because the available record does not document bracketing, reflexive phenomenological interviewing, or a phenomenological analytic protocol. The design is consistent with case-study attention to bounded context while transparently limiting interpretation to the evidence preserved in the documentary record (Creswell & Poth, 2018; Yin, 2018).

The unit of synthesis is the school-level process through which digital access was represented as becoming perceived academic value. Analytical subunits are institutional policy and infrastructure, curriculum and pedagogy, student digital practices, assessment, home-access conditions, and stakeholder coordination. Evidence from these subunits was integrated through a source-to-theme matrix and interpreted at the case level. The design is explanatory in a qualitative sense but does not estimate a causal effect or a statistical relationship with grades.

Research Site and Reported Participants

SMA Negeri 1 Amurang is a public senior secondary school in North Sulawesi, Indonesia. It was treated as an information-rich setting because the available record describes established digital-literacy initiatives, ICT facilities, technology-supported teaching, a recurring 30-minute literacy period, and documented implementation constraints. The original participant pool comprised Grade XI students, subject teachers, the principal, and vice principals directly involved in digital-learning policy or practice.

The available record identifies stakeholder categories but does not preserve exact participant counts, group distribution, demographic characteristics, refusals, withdrawals, recruitment dates, fieldwork duration, or the criterion used to conclude recruitment. No values have been estimated or reconstructed. Consequently, information power, stakeholder balance, and recruitment completion cannot be independently assessed. The findings are therefore interpreted at the level of the documented case rather than as a fully reproducible participant-based account.

Reported Data Sources

The original study report describes semi-structured interviews with students, teachers, and school managers. Reported interview domains included technology use in learning, perceived benefits for understanding and assignments, implementation barriers, ethical and safety concerns, home access, assessment practices, and digital-literacy development. The record does not specify the number, duration, format, language, or location of interviews, nor does it provide the interview guide or transcription protocol.

The report also describes classroom and computer-laboratory observations and document analysis. Observation summaries addressed technologies in use, learning activities, teacher mediation, student interaction, collaboration, off-task behavior, and infrastructure. Documents reportedly included curricula, syllabi, lesson designs, assessment materials, academic records, and student digital products such as presentations, videos, and blogs. The number and duration of observation sessions, researcher participation level, document inclusion criteria, and document inventory are not available.

A voice recorder, field notebook, and camera were reported as documentation tools. The available record does not identify the subjects, periods, indicators, or comparison logic of the academic records reviewed. Accordingly, academic records are treated only as a reported source category and are not used to claim a numerical improvement in grades.

Documentary Synthesis Procedure

For the present documentary synthesis, case statements were extracted from the available report and coded into deductive domains: institutional policy and infrastructure, curriculum and pedagogy, student practices, assessment, home access, and stakeholder coordination. Inductive constraints included distraction, network instability, assessment inconsistency, and application-specific use. Each statement was classified as (a) reported case evidence, (b) interpretation based on convergence across reported source categories, or (c) a literature-informed proposition. A source-to-theme matrix was used to prevent literature-informed propositions from being presented as direct findings. This procedure drew on the logic of data condensation, display, and conclusion drawing and used thematic principles to maintain coherence between codes, categories, and interpretive claims (Braun & Clarke, 2006; Miles et al., 2014).

The available record does not identify the number of original coders, independent or collaborative coding procedures, a formal codebook, disagreement resolution, negative-case analysis, or researcher positionality. No inter-coder coefficient is therefore claimed. Alternative explanations are addressed in the Discussion, and the institutional-curricular framework is explicitly labeled provisional.

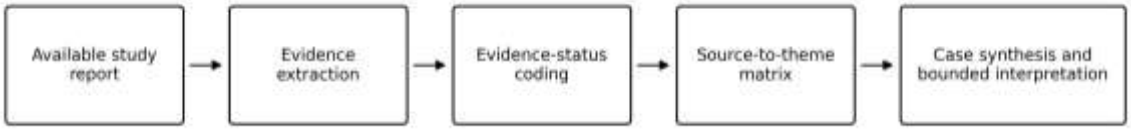

Figure 1. Documentary qualitative case-synthesis procedure

Trustworthiness, Ethics, and Data Governance

The original report states that source comparison, method triangulation, and participant checking were used. Because no member-checking materials, audit trail, or raw evidence were available, these procedures cannot be independently audited. The revised manuscript therefore uses the narrower formulation reported cross-source convergence rather than implying full interpretive validation. Convergence is described only where the report explicitly indicates agreement across stakeholder or evidence categories.

Transferability depends on contextual fit rather than statistical generalization. Researcher positionality and the original data-governance protocol were not documented in the available record. The record confirms school authorization and participant agreement but does not identify an institutional ethics approval or exemption reference, parental or guardian consent and student assent, data-storage location, access controls, retention period, or de-identification procedures. No direct quotation, identifiable student product, or raw academic record is

reproduced in this documentary synthesis. These missing records remain an ethical and reporting limitation.

RESULTS AND DISCUSSION

The results are presented as a documentary synthesis of the case report. Because raw quotations, observation excerpts, participant codes, student-product exemplars, and academic-record values were unavailable, the statements below are phrased as reported patterns rather than independently audited primary findings.

Institutional Enablers and the Access-to-Value Conversion

The available case report indicates that digital literacy had moved beyond isolated classroom experimentation and had become an explicit school concern. The school reportedly provided ethical-use education, broad access to ICT facilities, and regular teacher training. A distinctive institutional routine was a 30-minute digital-literacy period scheduled from Monday through Thursday. The record does not identify who facilitated the period, the detailed curriculum, whether participation was mandatory, or whether the schedule operated throughout the complete fieldwork period.

School facilities were described as relatively available, with plans for additional computers and digital classrooms. The report records classroom and computer-laboratory observations in which technology was used for learning. In-school provision nevertheless did not guarantee continuity across the full learning day: budget constraints limited expansion, and home device availability and network quality varied.

The reported evidence supports interpreting policy and infrastructure as enabling conditions, not as sufficient causes of achievement. Their perceived educational value depended on subject-specific tasks, students' strategic use, and the continuity of access when work extended beyond school. The contrast between broad school provision and unequal home connectivity is therefore a central case feature.

The documented case supports the proposition that access is necessary but insufficient for perceived academic value. The strongest case-specific contrast is between relatively broad in-school provision and variable benefits shaped by curricular tasks, information judgment, and attention. This is consistent with research showing that operational confidence does not guarantee evaluative or strategic competence (Gui & Argentin, 2011; Hatlevik et al., 2015), but the present synthesis does not independently measure students' competence levels. This interpretation is also consistent with evidence that the effectiveness of digital tools in secondary education depends on pedagogical purpose and teacher support (Hillmayr et al., 2020).

The recurring 30-minute digital-literacy period is a potentially important institutional routine because it reserves time for competence development. Its contribution cannot be evaluated fully, however, because facilitator, curriculum, attendance requirements, and duration of implementation were not documented. The cross-subject examples in Indonesian-language learning and social studies provide stronger evidence of curricular mediation than the existence of a stand-alone period alone.

One explanation for the perceived improvement in assignment quality is that digital production makes students’ thinking visible. To create a presentation, video, blog, or model, students must select content, sequence ideas, combine modes, and anticipate an audience. These processes can promote deeper engagement, but only when task criteria prioritize reasoning and evidence rather than visual polish. Canva and similar tools may lower design barriers, yet templates can also conceal superficial understanding. Teachers should therefore distinguish production fluency from conceptual quality through rubrics that assess accuracy, evidence, synthesis, attribution, and reflection.

Curriculum Integration and Assessment Coherence

The report describes digital literacy as integrated across subjects rather than confined to an ICT course. Examples include digital content creation in Indonesian-language learning, modeling in social studies, and collaborative projects. These activities moved students from consumption toward production and communication, although the available record does not include task instructions or student-product exemplars that would permit independent judgment of cognitive demand.

The school's reported competency expectations covered technology mastery, thinking skills, safety and ethics, and collaboration. This multidimensional structure is conceptually aligned with contemporary digital-literacy frameworks. However, the available record does not provide progression descriptors or performance standards showing how the domains were operationalized across subjects.

Assessment reportedly included monthly portfolios, semester tests, three-month process assessments, and annual surveys. This arrangement could capture products and development over time, but the report also identifies inconsistent criteria across subjects and network-related submission problems. The evidence therefore supports the conclusion that multiple assessment components existed while calibration, fairness, and comparability remained incomplete.

The school’s teacher-training policy and planned infrastructure expansion indicate supportive leadership. Yet the inconsistent application of assessment criteria shows that digital transformation requires more than resource allocation. Teachers need shared language for competence progression, opportunities to moderate student work, and examples of acceptable evidence across subjects. Falloon’s (2020) teacher digital-competency framework similarly integrates technical, pedagogical, ethical, and professional dimensions, while Pettersson (2018) argues that digital competence must be interpreted within organizational contexts. The problem is not unique to this case: international synthesis shows that teacher digital competence is measured inconsistently and is often insufficiently connected to students’ higher-order digital activity (Claro et al., 2024).

Rubric calibration is a practical leverage point. A common core rubric could assess information quality, disciplinary understanding, digital creation, collaboration, ethics, and reflection, while subject-specific descriptors could preserve disciplinary differences. Monthly portfolios and periodic process assessment already provide a foundation for this approach. Moderation meetings would allow teachers to compare samples, discuss borderline cases, and agree on how network failures should be handled. This would improve fairness and generate more credible evidence of progress. Formative-assessment research supports this direction because rubrics can improve transparency, learner agency, and scoring consistency when accompanied by exemplars, shared interpretation, and moderation (English et al., 2022; Panadero & Jonsson, 2013).

Leadership should also connect professional development to observed needs. General application training may help beginners, but the next stage should involve lesson design, source-evaluation pedagogy, AI literacy, accessibility, data privacy, formative feedback, and assessment. Sustained communities of practice are more likely than one-off workshops to produce consistent classroom use because teachers can plan, test, examine student work, and revise together (Tondeur et al., 2012). School leaders can support this process by protecting collaborative time, recognizing experimentation, and monitoring whether technology use advances learning objectives.

Table 1. Reported thematic patterns, case-bounded interpretations, and implications

Theme	Reported case evidence	Case-bounded interpretation	Implication (not an observed outcome)
Institutional enabling conditions	Ethical-use education; teacher training; broad school ICT access; 30-minute literacy period Monday–Thursday; planned computers and digital classrooms	Institutional commitment creates regular opportunities but does not by itself ensure learning quality	Protect recurring time, maintain facilities, and align professional learning with classroom evidence
Curricular mediation	Content creation in Indonesian; modeling in social studies; collaborative projects; four competence domains	Subject tasks convert access into disciplinary and higher-order practice	Develop subject-specific guides and a coherent progression of competence
Learning-oriented practice	Use of Google services, AI tools, and Canva; presentations, videos, and blogs; perceived gains in understanding and assignment quality.	Perceived academic value may be mediated by information use, creation, collaboration, and self-regulation.	Teach source evaluation, AI verification, attribution, and reflection
Equity and attention constraints	Unequal home devices and connectivity; unstable networks; gaming and social-media distraction	Opportunity and outcomes vary even when school access is broad	Expand supervised after-school access, low-bandwidth options, and self-regulation support
Assessment coherence	Monthly portfolios, semester tests, three-month process assessments, annual surveys; inconsistent criteria	Multiple evidence sources exist, but weak calibration limits fairness and comparability	Use common core rubrics, moderation meetings, and controlled performance tasks

Student Digital Practices, AI Use, and Perceived Academic Value

Students were reported to use Google services, AI tools, and Canva. Google-supported searching and document work were associated with information retrieval and organization; AI tools were used for explanations or assistance; and Canva supported presentations and visual products. Stakeholders associated these practices with clearer understanding and stronger assignment products. Presentations, videos, and blogs were named as evidence categories, but no anonymized exemplars were available for reanalysis.

The case report suggests four plausible pathways to perceived academic value: access to multiple explanations, cognitive reorganization through multimedia production, peer assistance during collaborative projects, and reduced procedural barriers through examples and templates. These pathways are interpretations of reported practice, not direct measurements of learning mechanisms.

No numerical improvement in grades can be attributed to digital literacy. Although academic records were listed among the documentary sources and stakeholders reportedly perceived improvement, baseline and follow-up scores, subject-level comparisons, indicators, and effect sizes were not preserved in the available record. The defensible conclusion is therefore a qualitative association with conceptual clarification, participation, and assignment quality; the magnitude and causality of achievement change remain untested.

The reported pathways are compatible with literature linking digital literacy to academic outcomes (Lei et al., 2021; Li et al., 2025), but the case contributes an implementation interpretation rather than an achievement-effect estimate. Multiple explanations, faster retrieval, improved organization, collaboration, and stronger products are plausible mechanisms. Prior achievement, subject difficulty, teacher expertise, student motivation, and socioeconomic resources were not measured and could also explain differences in understanding or assignment quality.

Self-efficacy is especially relevant to the use of unfamiliar tools. Students who believe they can solve technical and information problems are more likely to persist, explore alternatives, and revise their work. Rohatgi et al. (2016) linked ICT self-efficacy and perceived usefulness to students' engagement and achievement-related outcomes. In the present case, frequent opportunities to use Google services, AI tools, and Canva may have strengthened confidence through successful practice. The school should nevertheless avoid equating confidence with competence. Performance-based tasks are needed to determine whether students can verify claims, identify bias, use AI outputs responsibly, and explain their decisions (Claro et al., 2012; Jin et al., 2020).

The reported use of AI tools adds both learning possibilities and governance risks. AI tools can provide explanations, examples, feedback, and language support, but can also generate inaccurate information, obscure authorship, and expose personal data. The record does not specify the systems used, task types, verification procedures, disclosure expectations, data entered into AI systems, or academic-integrity rules. AI literacy and data-protection procedures should therefore be treated as future implementation priorities rather than as demonstrated features of the case (Long & Magerko, 2020).

Equity, Attention, and the Home-School Boundary

Three constraints repeatedly limited the conversion of technology into academic value. The first was unequal access outside school. Students who lacked reliable devices or connections at home had fewer opportunities to continue research, collaborate synchronously, upload products, or revise work. This gap persisted despite relatively broad access within school. It also created an assessment concern because delayed or incomplete submission could reflect infrastructure rather than competence or effort.

The second constraint was attention management. Games and social-media platforms competed with learning activities, and some students had difficulty sustaining focus. The same device could shift instantly from a learning resource to an entertainment environment. This made self-regulation, task design, classroom monitoring, and ethical-use education central components of digital literacy. The problem was not simply inappropriate behavior; it reflected a structural feature of contemporary digital environments in which educational and persuasive entertainment systems coexist.

The third constraint was inconsistency in implementation and assessment. Competency domains were defined, but teachers needed greater agreement about rubrics, evidence standards, and how to account for network constraints. Without calibration, students could encounter different definitions of quality across subjects. The school's digital-literacy initiative was therefore more mature at the level of intention and activity than at the level of cross-disciplinary measurement.

The persistence of home-access inequality is theoretically and practically important. It shows that a school can achieve relatively broad internal provision while students remain unequally positioned to benefit from homework, asynchronous collaboration, or extended digital projects. This pattern is consistent with second- and third-level digital-divide research, which shifts attention from access to skills, use, and outcomes (Scheerder et al., 2017). Socioeconomic differences in ICT literacy also remain evident across studies (Scherer & Siddiq, 2019). The persistence of material-access differences after basic connectivity expands is consistent with digital-divide research on device quality, autonomy, and continuing access costs (van Deursen & van Dijk, 2019).

After-school access to school facilities is therefore not merely a convenience; it is an equity intervention. The school's recommendation to make technology available beyond formal hours would provide a stable environment for students who lack devices or connectivity. Such access

should be accompanied by supervision, technical assistance, safeguarding procedures, and scheduling that accounts for transport and family responsibilities. Offline or low-bandwidth alternatives should also be available so that learning objectives are not contingent on continuous connectivity.

Assessment policy should avoid confusing infrastructure advantage with digital competence. Controlled in-school performance tasks, flexible contingencies for verified network failure, and shared rubrics could improve fairness. This implication is grounded in the report's weaker convergence for access equality and measurement consistency, but its effectiveness was not evaluated in the present case.

Distraction from games and social media was not an incidental finding; it was a major boundary condition. The result agrees with evidence that multitasking can impair learning and that some patterns of intensive smartphone use are negatively associated with academic performance (Amez & Baert, 2020; Sana et al., 2013). Restrictive rules may be necessary in some contexts, but they are insufficient because students also need self-regulation strategies that transfer beyond supervised classrooms. A review focused on secondary students similarly found that excessive or recreational social-network use was more consistently associated with weaker academic outcomes than purposeful educational use (Astatke et al., 2023).

Digital character education should therefore be operational rather than rhetorical. Students can learn to set goals, disable notifications, separate academic and entertainment accounts, use focus intervals, evaluate persuasive design, document sources, protect personal data, and reflect on their digital habits. Ethical competence should include respectful communication, copyright and attribution, academic integrity, AI disclosure, privacy, and awareness of harmful content. These practices connect the school’s four competency domains—technology mastery, thinking, safety and ethics, and collaboration—into observable behavior.

Parent engagement is equally important because much digital activity occurs at home. The proposed regular meetings and parent working groups could shift communication from general warnings toward practical co-regulation. Families need concise guidance on learning applications, reasonable routines, signs of problematic use, privacy, and how to support students without completing tasks for them. Parent involvement should be sensitive to differences in digital confidence and should not transfer the school’s responsibility to families with limited resources.

Cross-Source Synthesis and the Institutional-Curricular Heuristic

The study report describes strong convergence across stakeholder and evidence categories for routine technology use, curriculum integration, perceived benefits for academic work, and constraints involving access, network quality, and attention. Convergence was described as moderate to high for assessment standards, equality of access, and integration effectiveness, suggesting greater variation by subject, teacher, or home situation. Because source-level extracts are unavailable, these convergence judgments are reported rather than independently recalculated.

Taken together, the documented patterns support a provisional institutional-curricular heuristic. Policy, infrastructure, scheduling, and teacher development create opportunities; curriculum and pedagogy convert opportunities into tasks; student information use, creation, collaboration, and self-regulation shape learning processes; and assessment determines which practices are recognized. Home access, network stability, digital ethics, distraction, and family support operate as case-informed boundary conditions. Directional and moderating relationships remain propositions for future testing rather than findings of a validated model.

The contribution is best characterized as contextual integration. Multidimensional competence frameworks define relevant skills; technology-acceptance models explain

adoption; and digital-divide perspectives explain unequal access, use, and outcomes. The institutional-curricular heuristic connects these established insights through a school implementation chain: institutional enablers, curricular mediation, student digital practices, learning processes, and perceived academic value, with assessment and home-school conditions shaping the conversion process.

What the heuristic adds is not a new set of competence domains but an explicit emphasis on cross-subject assessment calibration and the home-school boundary as conversion conditions. It is therefore an implementation heuristic for organizing inquiry and school improvement, not a replacement for Ng's competence model, DigComp-related frameworks, TAM/UTAUT, or digital-divide theory. The single documentary case does not validate the arrows, mediators, moderators, or feedback loop shown in Figure 1.

The heuristic generates testable propositions for subsequent research: cognitively demanding curriculum integration may strengthen the relationship between provision and learning value; information judgment, self-efficacy, and product quality may mediate this relationship; home-access inequality and distraction may weaken it; and calibrated assessment and family support may strengthen it. These propositions draw jointly on the case synthesis and prior literature and require multi-site, longitudinal, or intervention-based evaluation.

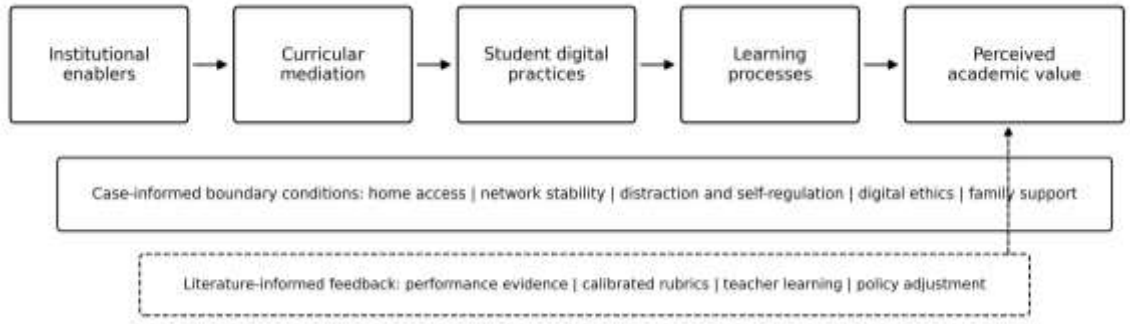

Figure 2. Provisional institutional-curricular heuristic for converting digital access into perceived academic value

Table 2. Positioning the institutional-curricular heuristic relative to established frameworks

Framework	Primary focus	What it clarifies	Specific addition of the present heuristic
Multidimensional competence frameworks (Ng, 2012; Redecker, 2017)	Technical, cognitive, communicative, creative, safety, and ethical domains.	What students and educators should be able to do.	Links competence domains to cross-subject curriculum, assessment calibration, and school-home conditions.
Technology acceptance / UTAUT (Davis, 1989; Venkatesh et al., 2003)	Usefulness, ease of use, social influence, and facilitating conditions.	Why actors adopt and continue using technology.	Distinguishes adoption from educational conversion and perceived academic value.
Digital-divide perspectives (Scheerder et al., 2017)	Access, skills, patterns of use, and outcomes.	Why opportunities and benefits remain unequal.	Places home access and network stability as boundary conditions within a school implementation chain.
Institutional-curricular heuristic (present synthesis)	Policy and infrastructure -> curricular mediation -> student practice -> learning processes -> perceived academic value.	How school-level elements may operate as a connected implementation ecology.	Adds cross-subject assessment coherence and an explicit feedback pathway; remains provisional and case-bounded.

Practical and Policy Implications

Implementation priorities should be sequenced by authority, cost, and evidentiary basis. Immediate school-level actions include subject-specific guidance, a common core rubric, and teacher moderation of student work. Medium-term investments include network maintenance, supervised after-school access, and protected time for teacher communities of practice. System-level actions include validated performance-based assessment and funding for maintenance and low-bandwidth alternatives.

Each action requires an accountable actor and an observable indicator. School leaders and curriculum teams can monitor whether guidance appears in lesson plans, whether rubric-moderation meetings occur, and whether network-related non-submission declines. District or provincial authorities can evaluate digital-literacy programs through performance and equity indicators rather than device counts alone. Actions derived directly from the case are distinguished from broader literature-informed recommendations in Table 6.

At classroom level, technology should serve a disciplinary purpose without replacing reasoning. Tasks may require students to compare source credibility, visualize local data, produce evidence-based multimedia explanations, collaboratively annotate documents, or critique an AI-generated response. Documentation of sources, decisions, AI assistance, and verification steps would make critical and ethical digital literacy visible for assessment.

Table 3. Prioritized implementation and evaluation pathway

Priority / time horizon	Responsible actor	Action and minimum resources	Measurable indicator	Evidence basis
Immediate: subject guidance	Curriculum coordinator and subject teachers	Concise application, source-evaluation, AI-use, attribution, and accessibility guides; shared planning template.	Guides embedded in lesson plans and student tasks.	Case-derived.
Immediate: assessment calibration	Vice principal for curriculum and departments	Common core rubric, sample digital products, and scheduled moderation meetings.	Shared rubric, moderation minutes, annotated exemplars.	Case-derived.
Medium term: equitable access	School leadership and local education authority	Network maintenance, supervised after-school access, and low-bandwidth alternatives.	Access logs and fewer network-related non-submissions.	Case-derived plus literature-informed.
Medium term: professional learning	School leadership and teacher teams	Protected collaborative time for lesson study, peer observation, AI literacy, privacy, and formative assessment.	Revised lessons, peer-observation records, and teacher portfolios.	Literature-informed response to case need.
Ongoing: student and family regulation	Counselors, homeroom teachers, and parent representatives	Focus routines, privacy and integrity guidance, student reflection, and practical parent sessions.	Participation records, reflection logs, and incident trends.	Case-derived.
System level: performance and equity evaluation	District or provincial education authority	Validated scenario-based tasks, maintenance funding, and equity reporting beyond device counts.	Performance profiles, access-disparity indicators, and annual improvement targets.	Literature-informed.

Limitations and Future Research

A notable case pattern is the coexistence of relatively broad school provision with continuing home-access inequality and inconsistent assessment. This suggests asynchronous institutional development: policy and routine can advance faster than common measurement, while school access can improve faster than household access. The pattern helps explain why stakeholders may report both meaningful benefits and persistent barriers.

Transferability depends on similarity of context. The heuristic is most relevant to public secondary schools that already possess some in-school ICT capacity, integrate digital products across subjects, experience mixed household connectivity, and lack consistent assessment standards. It may be less applicable to schools with minimal in-school access, boarding arrangements, fully standardized digital assessments, or uniformly reliable home connectivity.

The synthesis has substantial limitations. It concerns one school and one grade level; participant counts, fieldwork dates, raw quotations, observation excerpts, coding files, academic-record indicators, and researcher positionality were not available. The results therefore represent a documentary reconstruction of perceived and reported contribution, not a fully auditable primary qualitative study or a causal estimate. Alternative explanations - including prior achievement, subject differences, teacher expertise, student motivation, and socioeconomic resources - were not measured. Ethics approval, consent documentation, and the original data-governance protocol also remain unverified in the available record.

Future research should conduct multi-site studies across urban, rural, and archipelagic settings; use performance-based digital-literacy instruments; and link these measures to longitudinal, subject-level achievement. Mixed-method designs could test mediation by information judgment, self-efficacy, and learning-product quality, as well as moderation by home access and distraction. Intervention studies should evaluate subject-specific guides, rubric calibration, after-school access, parent co-regulation, and AI-verification routines using explicit implementation and outcome indicators. Longitudinal performance-based designs are particularly important because recent evidence shows that digital-literacy trajectories can differ across educational stages and activity profiles (Lan et al., 2026).

CONCLUSION

This documentary case synthesis examined how digital literacy was organized and represented as contributing to perceived academic value in Grade XI at SMA Negeri 1 Amurang. The available record indicates that ethical-use policy, teacher development, in-school ICT access, a recurring 30-minute literacy period, cross-subject integration, and student use of Google services, AI tools, and Canva created opportunities for conceptual clarification, collaboration, and stronger assignment products. These opportunities were constrained by unequal home access, unstable connectivity, distraction, and inconsistent assessment. No causal effect or numerical improvement in grades was established. The study contributes a provisional institutional-curricular implementation heuristic that integrates institutional enablers, curricular mediation, student practice, assessment coherence, and the home-school boundary. Immediate priorities are subject-specific guidance and rubric calibration, followed by equitable access, sustained teacher learning, and student-family co-regulation. Future multi-site and longitudinal research should test the proposed relationships using performance-based digital-literacy measures, transparent field procedures, and clearly specified achievement indicators.

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