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Strengthening Digital Literacy Competencies of Local Educational Institutions in Bali Through International Community Service to Support SDG 4

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Abstract.
This community service program was carried out under the second edition of the Sustainable International Community Service Program (SICS Bali 2026), held on 29 June-2 July 2026 in Penglipuran Village and at Sekolah Dasar Negeri (SDN) 2 Kubu, Kubu Village, Kabupaten Bangli, Bali Province, Indonesia. Bangli is Bali's only landlocked, inland regency, with an agriculture-based economy distinct from the province's coastal tourism centers. The program brought together academics from Indonesia (Universitas Negeri Yogyakarta, Universitas PGRI Yogyakarta, Universitas Negeri Jakarta, and Universitas PGRI Semarang) together with international partner institutions-Universiti Malaysia Sarawak (UNIMAS) in Malaysia, University of Management and Technology in Vietnam, and University of the Immaculate Conception in the Philippines-to strengthen the digital literacy competencies of a local elementary school as a contribution toward Sustainable Development Goal 4 (Quality Education). The activity used a participatory, observation-based community engagement approach comprising a needs assessment, hands-on training on digital teaching media and content creation anchored to the DigComp/DigCompEdu framework, and mentoring for teachers and school staff. Baseline conditions were triangulated using secondary data published by BPS-Statistics Indonesia (including BPS-Statistics of Bangli Regency) and the Ministry of Communication and Digital Affairs (Komdigi), which show that while Bali's provincial internet access rate (77.56%) and Digital Society Index (IMDI) score (49.05 in 2024) exceed national averages, this advantage is unevenly distributed and is not automatically enjoyed by inland, agrarian regencies such as Bangli. Field observation and mentoring sessions at SDN 2 Kubu revealed that the school had not fully translated the province's general digital advantage into structured pedagogical practice, confirming a persistent access-utilization gap at the local level. The program strengthened teachers' confidence in operating digital learning media, encouraged the co-creation of locally contextualized digital teaching materials, and demonstrated an international, multi-country collaborative model for

community-based digital literacy empowerment that can be replicated in other inland, cultural-heritage villages of Bali.
Keywords: *Community service; Digital competence; Digital literacy; Educational institutions; SDG 4.*

I. INTRODUCTION

Digital literacy has become a central pillar of the global education agenda since the adoption of the 2030 Agenda for Sustainable Development, whose fourth goal (SDG 4) calls for inclusive and equitable quality education and lifelong learning for all (United Nations, 2015). Digital literacy is commonly understood as the ability to access, manage, understand, evaluate, and create information safely through digital technologies, a concept that has evolved from earlier information literacy toward a broader, competence-based mapping of digital participation (Ala-Mutka, 2011; Bawden, 2001). The World Bank frames this shift as part of a "digital dividends" agenda, in which returns from digital investment materialize only when access is matched by complementary skills and institutions (World Bank, 2016). The European Commission's DigComp and DigCompEdu frameworks, together with UNESCO's global framework for SDG indicator 4.4.2, operationalize this competence into concrete dimensions-information and data literacy, communication and collaboration, digital content creation, safety, and problem solving-since adopted and validated across many national contexts (Caena & Redecker, 2019; Carretero et al., 2017; Ferrari, 2013; UNESCO, 2018; Vuorikari et al., 2022).

Empirical studies from the last five years consistently show that possessing digital infrastructure does not automatically translate into digital pedagogical competence. In China, a validated self-assessment instrument revealed that secondary school teachers' actual competence lagged behind their institutions' technological access (Jiang & Yu, 2023), while a study of Hungarian teacher educators found that DigCompEdu-based self-reflection tools are useful precisely because teachers routinely overestimate operational skills relative to pedagogical and content-creation skills (Horváth et al., 2024). A broader digital competence framework for learners similarly argues that access-oriented indicators are insufficient without a parallel focus on empowerment and applied use (Hammoda & Foli, 2024). Community-based interventions elsewhere show comparable value: a digital literacy movement for elementary school children in an Indonesian city built contextual competence through participatory, volunteer-supported methods rather than formal curricula alone (Abiddin et al., 2022), while a similar movement for elementary school teachers relied on community mentoring rather than one-off training (Diputra et al., 2020). More broadly in Indonesia, sustained mentoring-rather than one-off training-has been shown to convert nominal digital access into classroom practice (Rasmitadila et al., 2025), a pattern also echoed in studies of how Indonesian university students understand and enact SDG 4 (Lubis & Pusparani, 2022).

Indonesia's own official statistics reflect this access-utilization tension at the sub-national level. The proportion of the national population accessing the internet reached 72.78% in 2024, with Bali Province recording one of the highest rates in the country at 77.56%, sixth among Indonesia's 38 provinces (BPS, 2025a). Bali's overall digital readiness, measured by the government's Indeks Masyarakat Digital Indonesia (IMDI), likewise exceeded the national average in both 2024 (49.05 vs. 43.34) and 2025 (48.22 vs. 44.53) (BPSDM Komdigi Yogyakarta, 2026). However, the 2025

IMDI report cautions that while Bali's Infrastructure and Ecosystem pillar scores well above 60, its Empowerment pillar-reflecting whether technology is actually used to improve productivity, entrepreneurship, and innovation-remains at 34.27-41.95, below the national average for that pillar. The Ministry of Communication and Digital Affairs has likewise emphasized that digital literacy needs strengthening across four pillars-digital ethics, digital culture, digital skills, and digital security-rather than access alone(Siberkreasi.id, 2023). This gap between favorable infrastructure statistics and comparatively weak empowerment outcomes is the empirical starting point of the present community service program.

The second edition of the Sustainable International Community Service Program (SICS Bali 2026) was designed around this rationale. Organized by Indonesian universities-including Universitas Negeri Yogyakarta, Universitas PGRI Yogyakarta, Universitas Negeri Jakarta, and Universitas PGRI Semarang-together with international partners Universiti Malaysia Sarawak (UNIMAS) in Malaysia, University of Management and Technology in Vietnam, and University of the Immaculate Conception in the Philippines, the program connected academics with local Balinese communities through a collaborative, participatory observation approach, with three intersecting focal areas: strengthening MSMEs, the tourism sector, and educational institutions, to increase regional competitiveness and support the SDGs. This article reports on the educational-institution strand of that broader program: strengthening digital literacy competencies at Sekolah Dasar Negeri (SDN) 2 Kubu, in Kubu Village, adjacent to the cultural-heritage tourism village of Penglipuran, in Kabupaten Bangli, Bali.

Kabupaten Bangli is Bali's only regency without a coastline: a landlocked, mountainous area of 520.81 km2 with a population of about 262,300 (roughly 6% of Bali's total), and an economy that remains predominantly agriculture-based (BPS, 2024). This places Bangli structurally apart from Bali's high-tourism coastal regencies, even though it hosts Penglipuran-one of Indonesia's most internationally recognized cultural-heritage tourism villages, whose sustainability depends heavily on government facilitation and community-based management of customary land and creative-economy assets (Adi et al., 2017; Astara et al., 2022). Most existing Indonesian community-service literature on digital literacy has focused either on remote rural villages with limited connectivity or on teacher cohorts detached from any specific economic or geographic context, with comparatively little attention paid to school communities in an inland, agrarian regency that also hosts a globally recognized cultural tourism destination, where provincial statistics may not reflect the specific school-level condition. National panel-data analysis of BPS education data confirms that school internet access remains highly uneven across Indonesia, with a Gini index of 0.42 separating better-connected western regions from less-connected eastern regions (Setiaji et al., 2025), underscoring that provincial averages can mask considerable disparity. This originality motivates the present study, which aims to (1) describe the baseline digital literacy condition at SDN 2 Kubu relative to provincial and national indicators, (2) describe the interventions implemented to close the access-utilization gap, and (3) discuss the resulting changes and their relevance to SDG 4.

II. METHODS

This community service activity employed a participatory, collaborative observation-based community engagement approach, consistent with the SICS Bali 2026 program design and with the

broader tradition of Participatory Action Research (PAR) as a vehicle for teacher professional development, in which practitioners and facilitators jointly define problems, act, and reflect rather than positioning teachers as passive training recipients (Morales, 2016). The approach combined three techniques: (a) a rapid needs assessment through classroom observation and informal conversation with teachers and school leaders; (b) hands-on workshops on digital teaching media, content-creation tools, and information-safety practices, structured around the five DigComp/DigCompEdu competence areas (Caena & Redecker, 2019); and (c) short mentoring sessions in which the multi-country facilitator team-comprising academics from Universitas Negeri Yogyakarta, Universiti Malaysia Sarawak, University of Management and Technology, Universitas PGRI Yogyakarta, Universitas Negeri Jakarta, Universitas PGRI Semarang, and University of the Immaculate Conception-worked alongside teachers to co-produce simple digital learning materials.

Data were collected through triangulated sources to ensure validity and reliability. Primary qualitative data consisted of field observation notes, informal interviews and small-group discussions with teachers and administrators at SDN 2 Kubu, and documentation of the training and mentoring sessions. These were cross-checked against secondary quantitative data from publicly accessible government publications: internet access by province (BPS, 2025a); the Community Literacy Development Index by regency/municipality in Bali Province (BPS, 2025b); the Kabupaten Bangli regency profile (BPS, 2024); the national IMDI report (BPSDM Komdigi Yogyakarta, 2026); and a national panel-data study of school-level technology access disparities across (Setiaji et al., 2025). Using official secondary statistics for the situational baseline-rather than relying solely on a single-session self-report questionnaire-was intended to validate whether the general provincial trend held at the school level, and to avoid overstating short-term training effects that a four-day intervention cannot reliably measure.

The activity took place over four days, from 29 June to 2 July 2026, centered on Penglipuran Village and SDN 2 Kubu in Kubu Village, Kabupaten Bangli, Bali, embedded within the wider second-edition SICS Bali 2026 schedule that also included a welcoming session, community development (ComDev) activities, and cultural-exchange components. The team's initial hypothesis-informed by the literature reviewed above-was that, despite Bali province's above-average digital statistics, an inland, agrarian, non-coastal school such as SDN 2 Kubu would likely exhibit lower digital infrastructure access and applied pedagogical competence than the provincial average would suggest, mirroring the access-utilization and geographic-disparity gaps documented elsewhere in Indonesia (Jiang & Yu, 2023; Rasmitadila et al., 2025; Setiaji et al., 2025). This was treated as a working assumption to be confirmed or revised through direct observation. The anticipated outcome was improved teacher confidence and practical skill in using digital learning media, the beginning of locally co-created digital teaching content, and a documented, replicable model that future SICS iterations could extend to other inland, cultural-heritage villages in Bali.

III. RESULT AND DISCUSSION

Table 1 summarizes the secondary statistical indicators used to establish the baseline digital-readiness condition of Bali Province relative to the national average. Both indicators confirm that, provincially, Bali's digital infrastructure and general digital-society readiness are above the national mean: internet access of 77.56% exceeds the national 72.78% (BPS, 2025a), and its IMDI

score exceeded the national score in both 2024 (49.05 vs. 43.34) and 2025 (48.22 vs. 44.53) (BPSDM Komdigi Yogyakarta, 2026). Yet the 2025 IMDI report flags that the Empowerment pillar-reflecting whether digital technology is actually converted into productivity, entrepreneurship, and applied skill-remains comparatively weak in Bali and its peer cultural-hub provinces. These are provincial averages, however, and Kabupaten Bangli-the specific service location-is structurally atypical within that average: Bali's only landlocked regency, agrarian in economic base, home to only about 6% of the province's population (BPS, 2024). National panel-data analysis of school technology access likewise shows a Gini index of 0.42 nationally (Setiaji et al., 2025), confirming that provincial figures can conceal considerable disparity at the level of an individual inland school. This was corroborated by direct observation at SDN 2 Kubu: the school had basic connectivity and shared computer facilities, yet before the program the pedagogical use of these tools for lesson delivery, assessment, or student-created content was limited, and several teachers described their digital skills as self-taught and inconsistently applied.

Against this baseline, the team implemented DigComp-anchored workshop modules covering (a) information and data literacy, focusing on evaluating and organizing online educational resources; (b) digital content creation, in which teachers built simple slide-based and short-video materials incorporating local Balinese cultural content drawn from the surrounding Penglipuran environment; (c) communication and collaboration, including shared cloud folders and messaging groups for lesson coordination; and (d) digital safety, addressing basic practices for protecting student data and identifying misinformation. Sessions were facilitated jointly by the Indonesian team and visiting international partner academics, including colleagues from Universiti Malaysia Sarawak (UNIMAS), adding a cross-cultural dimension: facilitators shared how comparable practices are implemented in their own contexts, and teachers were able to compare these against Bangli's own agrarian-and-culture-oriented local curriculum. Following the workshops, most teachers were observed independently operating the demonstrated tools during mentoring, and several expressed willingness to integrate short digital assignments into regular teaching, although a four-day program is insufficient to produce durable, school-wide behavior change and should be read as an initiation rather than a completed transformation.

Table 1. Baseline digital-readiness indicators, Indonesia vs. Bali Province

Indicator	**Indonesia (national)**	**Bali Province**	**Source**
Population with internet access (2024)	72.78%	77.56%	BPS-Statistics Indonesia (2024a)
Indeks Masyarakat Digital Indonesia / IMDI (2024)	43.34	49.05	BPSDM Komdigi (2026)
Indeks Masyarakat Digital Indonesia / IMDI (2025)	44.53	48.22	BPSDM Komdigi (2026)

IMDI Empowerment pillar (2025)	national average (reference)	34.27-41.95 (below national avg. for this pillar)	BPSDM Komdigi (2026)



Figure 1. The community service team and international partner delegation-Indonesian universities (UNY, UPY, UNJ, UPGRIS), Universiti Malaysia Sarawak, University of Management and Technology, and University of the Immaculate Conception-at the entrance gate of Penglipuran Village, Kabupaten Bangli, marking the start of the second-edition SICS Bali 2026 program, 29 June-2 July 2026.



Figure 2. Documentation of the community service team's visit and mentoring session at Sekolah Dasar Negeri (SDN) 2 Kubu, Kubu Village, Kabupaten Bangli, together with local school representatives and the Bangli Regency Education, Youth, and Sports Office.

Figures 1 and 2 document these activities. Figure 1 shows the multi-country facilitator team at the entrance gate of Penglipuran Village, where the program's community-engagement activities were formally opened; the presence of academics from Indonesian partner universities alongside Universiti Malaysia Sarawak, University of Management and Technology, and University of the Immaculate Conception, visible on the program banner, illustrates the cross-institutional character of the intervention. Figure 2 documents the team's direct engagement at SDN 2 Kubu, including local school staff, community members, and the Bangli Regency Education, Youth, and Sports Office, whose participation supports the program's participatory observation approach and provides direct evidence-alongside the secondary statistics in Table 1-that the intervention was implemented at the intended school-community level rather than only at a general provincial scale.

These observations are broadly consistent with comparable Indonesian community-service interventions, which show that structured, hands-on digital literacy training-particularly when paired with follow-up mentoring rather than a single workshop-tends to produce measurable gains in participants' confidence and basic digital skill application (Rasmitadila et al., 2025). The specific percentage gains reported in such external studies are benchmarks drawn from the literature rather than measurements generated by the present four-day program, since no formal pre-test/post-test instrument was administered; the present program's own evidence base rests on qualitative observation, documentation such as Figures 1 and 2, and the secondary statistical triangulation described above.

The most notable institutional impact was the school's expressed intent to sustain the practices introduced-teachers requested continued access to training materials and asked about follow-up mentoring the coming semester. This suggests the intervention succeeded less in producing large one-time skill jumps and more in lowering the psychological and practical barriers that had discouraged teachers from experimenting with digital pedagogy, consistent with the confidence-building role DigCompEdu-based instruments are argued to serve (Horváth et al., 2024). The clearest limitation was Bangli's inland, agrarian setting itself: as a landlocked regency without the coastal tourism economy driving much of Bali's digital investment, SDN 2 Kubu's device availability depends more heavily on regency-level government provisioning than on tourism-linked private investment, echoing the general finding that provincial-level infrastructure gains do not distribute evenly across regencies with different economic bases.

IV. CONCLUSION

This community service program set out to strengthen digital literacy competencies at SDN 2 Kubu, adjacent to Penglipuran Village, Kabupaten Bangli, Bali, as part of the second edition of SICS Bali 2026, and to examine this effort in relation to SDG 4. Secondary statistical data confirmed that Bali's province-wide averages already exceed the national mean in digital infrastructure and digital-society readiness, yet both government reporting and field observation converged on the same conclusion: this provincial advantage does not automatically extend to an inland, agrarian regency such as Bangli, and applied, productive use of digital technology-rather than raw access-remained the binding constraint at the school level.

The program's principal benefit was not a large, precisely measured skill jump but a documented reduction in the barriers that had kept teachers from experimenting with digital

pedagogy, achieved through DigComp-anchored workshops and mentoring delivered by a multi-country academic team. This cross-national facilitation model-combining Indonesian academics from Universitas Negeri Yogyakarta, Universitas PGRI Yogyakarta, Universitas Negeri Jakarta, and Universitas PGRI Semarang with Universiti Malaysia Sarawak, University of Management and Technology, and University of the Immaculate Conception-is a distinctive contribution relative to single-country PKM digital-literacy interventions previously reported in the Indonesian literature.

Three recommendations follow for future community empowerment efforts. First, subsequent SICS iterations should extend beyond a single four-day cycle and incorporate formal follow-up mentoring, since teachers themselves requested continued support. Second, closer coordination with the Bangli Regency Education, Youth, and Sports Office and the provincial Communication and Informatics agency would help address device and connectivity gaps stemming from Bangli's inland, non-coastal economic base. Third, the inland, cultural-heritage-embedded digital-literacy empowerment model piloted here-linking digital pedagogy training explicitly to a school's surrounding agrarian and cultural-tourism context-merits replication for other landlocked or inland regencies in Bali and similar Indonesian destinations, where the binding constraint on SDG 4 progress is empowerment and applied use rather than raw provincial-level digital access.

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