



The Effectiveness of a Multimodal Entrepreneurship Module in Enhancing Digital Business Creativity among Equality Education Learners

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Abstract: Digital business creativity has become increasingly essential for learners in non-formal equality education (Package C programs) to achieve economic empowerment in the digital era. However, entrepreneurship instruction in equality education settings remains predominantly conventional and rarely incorporates multimodal strategies tailored to diverse learner characteristics. This study examined the effectiveness of a multimodal entrepreneurship module in enhancing digital business creativity among learners in equality education. A quasi-experimental pretest-posttest control group design was employed involving 80 learners from equality education programs in Semarang Regency, Indonesia, selected through purposive sampling and grouped into an experimental group ($n = 40$) and a control group ($n = 40$). The experimental group participated in an eight-week multimodal intervention integrating visual, auditory, digital simulation, and project-based learning activities, while the control group received conventional instruction. Data were collected using the adapted Digital Business Creativity Scale (DBCS), which demonstrated satisfactory reliability (Cronbach's $\alpha = .87$). Independent samples t-test and ANCOVA results indicated a significant difference in post-test scores between groups, $F(1,77) = 88.42$, $p < .001$, partial $\eta^2 = .53$, with a large effect size (Cohen's $d = 1.21$). The intervention significantly improved learners' digital ideation, innovation, content creation, and digital problem-solving skills. These findings provide empirical evidence that multimodal entrepreneurship pedagogy can serve as an effective instructional strategy for strengthening entrepreneurial empowerment in non-formal equality education contexts.

Keywords: multimodal learning, entrepreneurship education, digital creativity, equality education, nonformal education

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INTRODUCTION

Digital transformation has significantly reshaped entrepreneurial ecosystems in Indonesia, particularly through the expansion of digital platforms, e-commerce, and social media-based business models, which broaden access to digital business creation and entrepreneurial participation. In Indonesian educational contexts, recent studies also show that digital entrepreneurship education, entrepreneurial self-efficacy, and entrepreneurial attitudes are important predictors of digital business readiness and entrepreneurial intention among learners (Wardoyo et al., 2025; Wibowo et al., 2023). For learners in non-formal equality education, this transformation is especially relevant because entrepreneurial learning is expected to support not only economic participation but also adaptive and creative capacities to navigate digitally mediated markets (Sari et al., 2024). However, the effectiveness of entrepreneurship education in fostering digital innovation competencies remains uneven,

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particularly when instructional practices are still dominated by conventional approaches rather than technology-enhanced and creativity-oriented learning designs. Recent evidence suggests that digital entrepreneurial education is more effective when it is linked to creativity, digital literacy, and applied learning experiences, rather than limited to conceptual delivery alone (Duong et al., 2024; Liang et al., 2025). This issue is particularly important in equality education contexts, where learners often require instructional approaches that are flexible, contextual, and responsive to diverse learning characteristics.

Equality education, particularly Package C programs in Indonesia, plays a critical role in providing second-chance education opportunities for learners who have been excluded from formal schooling systems. These learners often come from socioeconomically disadvantaged backgrounds and experience limited access to digital infrastructure, instructional innovation, and experiential learning environments (Husnah et al., 2025; Ilyas et al., 2025; Nurhayati-Wolff, 2025). Although entrepreneurship education is frequently promoted as a strategy for empowerment and social mobility, pedagogical practices in equality education contexts tend to rely on conventional instructional models that may not adequately address the demands of the digital economy. Consequently, a substantial gap persists between the competencies required for digital entrepreneurship and the instructional practices implemented in non-formal education settings.

One critical competency for navigating the digital economy is digital business creativity. This construct extends beyond basic digital literacy and includes the capacity to generate innovative digital business ideas, develop digital content, adapt to evolving digital platforms, and solve entrepreneurial problems using technology (Cazan et al., 2024; Cojocariu & Boghian, 2024; Mulyono et al., 2023). Digital business creativity integrates creativity theory, digital competence frameworks, and entrepreneurial cognition, making it a multidimensional construct that can be operationalized and measured empirically. Recent scholarship emphasizes that digital business creativity is increasingly central to entrepreneurial sustainability, particularly in emerging economies where digital transformation accelerates market competition (Duong et al., 2024; Wibowo et al., 2024).

To effectively foster digital business creativity, instructional approaches must move beyond text-based delivery and adopt strategies that accommodate diverse learner characteristics. Multimodal learning provides a theoretically grounded framework by integrating visual, auditory, kinesthetic, and digital modes of engagement to support deeper understanding and active knowledge construction (Hazarika & Dagar, 2024; Lopes et al., 2025; Siahaan et al., 2024). In entrepreneurship education, multimodal strategies such as digital simulations, project-based learning, collaborative digital production, and multimedia storytelling can create experiential learning environments that stimulate innovation and applied problem-solving. These pedagogical approaches align with inclusive education principles and offer potential pathways for addressing heterogeneity in equality education classrooms.

Despite its theoretical promise, empirical investigations examining the causal impact of structured multimodal entrepreneurship interventions remain limited, particularly in non-formal education contexts. Existing research predominantly focuses on higher education or vocational institutions, and many studies emphasize entrepreneurial intention rather than measurable creativity outcomes (Cazan et al., 2024; Duong et al., 2024; Lopes et al., 2025). Moreover, studies conducted in equality education settings often adopt descriptive or qualitative designs, limiting causal inference and generalizability (Husnah et al., 2025; Ilyas et al., 2025). This methodological limitation restricts the evidence base needed to inform instructional innovation in community-based education programs.

Therefore, there is a clear contextual and methodological gap in understanding how structured multimodal entrepreneurship instruction influences digital business creativity among learners in equality education. Addressing this gap requires rigorous experimental designs and validated measurement instruments capable of capturing multidimensional creativity outcomes. Accordingly, this study aims to examine the effectiveness of a structured multimodal entrepreneurship module in enhancing digital business creativity among Package C learners in Semarang Regency, Indonesia. By employing a quasi-experimental pretest-posttest control group design and a validated creativity

instrument, this research contributes empirical evidence to strengthen pedagogical innovation and entrepreneurial empowerment within non-formal equality education contexts.

METHOD

Research Design

This study employed a quantitative quasi-experimental pretest–posttest control group design, specifically a nonequivalent control group design, to investigate the effectiveness of a structured multimodal entrepreneurship module in improving digital business creativity among learners in equality education. This design was selected because random assignment of individual learners was not feasible in the natural instructional setting of Package C classes; therefore, pre-existing classes were used as experimental and control groups. In educational research, quasi-experimental designs are considered appropriate for evaluating instructional interventions when randomization is impractical, provided that baseline measurement, comparison groups, and statistical controls are incorporated (Creswell & Poth, 2018). The inclusion of pretest and posttest measures enabled the researcher to assess changes in digital business creativity over time and to compare the magnitude of change across groups.

Moreover, pretest scores served as an important baseline indicator and were statistically controlled for using ANCOVA to adjust for initial differences and enhance the precision of treatment effect estimates. This analytical choice is supported by recent methodological literature emphasizing that ANCOVA is particularly useful for comparing two groups while accounting for covariates. However, its interpretation in nonrandomized studies should be approached with caution because study design and covariate imbalance may affect the conclusions drawn (Schwarz, 2025). Substantively, the design also aligns with recent scholarship on digital entrepreneurship education, which indicates that practice-oriented, digitally supported, and multimodal learning experiences can strengthen entrepreneurial competence, self-efficacy, creativity, and entrepreneurial intention more effectively than conventional content-delivery approaches (Chen & Ifenthaler, 2023; Ilyas et al., 2025). Therefore, the quasi-experimental pretest–posttest control group design was considered the most appropriate and feasible approach for examining the contribution of the multimodal entrepreneurship module within the real context of equality education.

Participants and Sampling

The participants consisted of 80 learners enrolled in Package C equality education programs in Semarang Regency, Central Java, Indonesia. They were selected through purposive sampling to ensure that all participants met the inclusion criteria, namely: (1) enrollment in the Package C program, (2) basic digital literacy skills, and (3) willingness to participate throughout the eight-week intervention. Purposive sampling is appropriate when researchers intentionally select participants based on specific characteristics directly relevant to the study's objectives and predefined inclusion criteria (Palinkas et al., 2015). Since this study adopted a quasi-experimental design, assignment to the experimental group ($n = 40$) and the control group ($n = 40$) was based on pre-existing class membership rather than random assignment. This approach is common in educational quasi-experimental research because intact classes are often used when random assignment is impractical in natural instructional settings, although such nonrandom assignment may introduce selection effects and therefore requires cautious interpretation of causal claims (Lindstromberg, 2025; Mansour & Wardat, 2025).

Intervention Procedure

The experimental group participated in an eight-week multimodal entrepreneurship module delivered in two sessions per week, each lasting 90 minutes. The instructional design integrated visual materials, video-based case studies, interactive digital simulations, collaborative project-based tasks, and practical digital content creation activities. This intervention structure reflects recent entrepreneurship education research emphasizing that experiential and multimodal learning can

improve engagement, applied competence, and entrepreneurial skill development beyond purely lecture-based approaches (Motta & Galina, 2023).

Learners were guided to develop digital business ideas, create promotional content, and simulate online marketing strategies. These activities are also consistent with findings showing that interactive start-up simulations and applied entrepreneurial tasks can strengthen students' active participation and practical entrepreneurial development (Sofiullah et al., 2023). In contrast, the control group received conventional entrepreneurship instruction consisting primarily of lecture-based delivery and textbook discussion without structured multimodal integration. Instructors with comparable teaching experience taught both groups to minimize instructor-related variability.

Instrumentation

Digital business creativity was measured using the Digital Business Creativity Scale (DBCS), developed by Cazan et al. (2024)(). The instrument comprises 25 items across four dimensions: digital ideation, digital innovation, digital content creation, and digital problem-solving. Responses were recorded on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The instrument was translated and culturally adapted using a forward-backward translation procedure. Three experts in entrepreneurship education and educational measurement reviewed the instrument to ensure content validity. A pilot study was conducted with 30 learners in equality education, separate from the main sample. The reliability test yielded a Cronbach's alpha coefficient of .87, indicating satisfactory internal consistency.

Data Collection Procedure

Data were collected at two time points: prior to the intervention (pre-test) and immediately after the eight-week intervention (post-test). This two-wave pretest-posttest procedure is appropriate for intervention studies because it enables the researcher to examine change over time while accounting for participants' baseline status in group comparisons (Skvarc & Fuller-Tyszkiewicz, 2024). Both groups completed the DBCS under supervised Classroom conditions to ensure standardized administration and consistent responses. Recent evidence on Classroom survey administration indicates that supervision mode and standardized procedures can influence data quality, including item nonresponse and response patterns (Stefes, 2024).

Data Analysis

Descriptive statistics, including means and standard deviations, were calculated to summarize the levels of digital business creativity in both groups. Prior to inferential analysis, the assumptions underlying parametric testing were examined using the Shapiro-Wilk test for normality and Levene's test for homogeneity of variance. Recent methodological literature emphasizes that assumption-based test selection is important for ensuring the validity, transparency, and interpretability of group-comparison analyses (Arredondo Montero, 2026). An independent-samples t-test was then conducted to examine differences between the experimental and control groups at baseline and post-test. To control for potential pre-test differences and improve statistical precision, Analysis of Covariance (ANCOVA) was performed using pre-test scores as the covariate. This procedure is widely used to compare two groups while adjusting for baseline covariates. However, its interpretation in nonrandomized studies should be approached with caution, as conclusions may still be influenced by study design and covariate imbalance (Schwarz, 2025). In addition, effect sizes were calculated using Cohen's d and partial eta squared to estimate the magnitude of the intervention effect, since standardized effect sizes are commonly used to complement significance testing by indicating the practical magnitude of group differences. They explained variance(Schäfer, 2025).

Ethical Considerations

Ethical approval for this study was obtained from the Ethics Committee of the Faculty of Psychology, Universitas Semarang, prior to data collection. All participants provided informed consent

before taking part in the study, and they were informed about the purpose of the research, the voluntary nature of participation, and the confidentiality of their responses. The study was conducted in accordance with contemporary ethical principles for research involving human participants, particularly those emphasizing prior ethical review, informed consent, respect for participant autonomy, and protection of privacy and confidentiality in educational research contexts (British Educational Research Association, 2024).

RESULTS AND DISCUSSION

Results

This study aimed to examine the effectiveness of a structured, multimodal entrepreneurship module in enhancing digital business creativity among learners in equality education. A total of 80 learners participated in the study and were equally assigned to the experimental and control groups. Prior to the intervention, baseline equivalence was tested to ensure that both groups had comparable levels of digital business creativity. The results of the independent samples t-test indicated no statistically significant difference between the experimental group ($M = 62.45$, $SD = 6.12$) and the control group ($M = 61.98$, $SD = 6.35$), $t(78) = 0.34$, $p > .05$. This result suggests that the two groups were comparable at baseline in terms of their initial scores. However, the findings should be interpreted within the limits of the quasi-experimental design.

Following the eight-week implementation of the multimodal entrepreneurship module, descriptive statistics revealed substantial improvements in digital business creativity scores, particularly in the experimental group. As presented in Table 1, the experimental group showed a marked increase from a pre-test mean of 62.45 to a post-test mean of 81.73, resulting in a mean gain of 19.28 points. In contrast, the control group demonstrated a more modest improvement from 61.98 to 68.21, with a mean gain of 6.23 points.

Table 1. Descriptive Statistics of Digital Business Creativity Scores

Group	Pre-test M (SD)	Post-test M (SD)	Mean Gain
Experimental (n=40)	62.45 (6.12)	81.73 (5.48)	19.28
Control (n=40)	61.98 (6.35)	68.21 (6.02)	6.23

To examine within-group changes, paired samples t-tests were conducted. The results indicated a statistically significant increase in digital business creativity in the experimental group, $t(39) = 14.87$, $p < .001$, demonstrating substantial improvement following exposure to the multimodal intervention. Although the control group also showed a statistically significant increase, $t(39) = 5.12$, $p < .05$, the magnitude of change was considerably smaller. This pattern suggests that while conventional instruction may contribute to incremental improvement, the multimodal module produced a substantially greater enhancement in creativity outcomes.

Between-group differences were further analyzed using an independent-samples t-test on post-test scores. The analysis revealed a significant difference between the experimental and control groups, $t(78) = 9.63$, $p < .001$, indicating that learners who received the multimodal intervention achieved significantly higher digital business creativity scores than those who received traditional instruction. To increase statistical rigor and control for baseline differences, Analysis of Covariance (ANCOVA) was conducted using pre-test scores as the covariate.

Table 2. Inferential Analysis of Post-Test Scores

Analysis	Statistic	p	Effect Size
Independent t-test	$t(78) = 9.63$	$< .001$	$d = 1.21$
ANCOVA (Group Effect)	$F(1,77) = 88.42$	$< .001$	Partial $\eta^2 = .53$

The ANCOVA results confirmed a statistically significant main effect of the intervention, $F(1,77) = 88.42, p < .001$, with a partial eta squared value of .53. The ANCOVA results showed a statistically significant main effect of the intervention, $F(1, 77) = 88.42, p < .001$, with a partial eta squared of .53, indicating a substantial effect associated with the intervention on post-test digital business creativity scores after controlling for baseline scores. In addition, Cohen's d value of 1.21 indicates a large effect size, suggesting that the observed differences were not only statistically significant but also educationally meaningful.

To gain a more detailed understanding of the intervention's impact, post-test scores were analyzed across the four dimensions of digital business creativity: digital ideation, digital innovation, digital content creation, and digital problem-solving. The results, summarized in Table 3, show consistent superiority of the experimental group across all dimensions.

Table 3. Post-Test Mean Scores by DBCS Dimension

Dimension	Experimental (M)	Control (M)
Digital Ideation	20.4	16.2
Digital Innovation	21.1	15.8
Digital Content Creation	20.7	17.0
Digital Problem-Solving	19.5	19.2

The largest differences were observed in digital innovation and digital content creation, suggesting that multimodal instructional components such as simulation-based activities, collaborative digital production, and multimedia integration may have contributed particularly to the applied and productive aspects of digital creativity. Overall, these findings provide strong empirical evidence that the structured multimodal entrepreneurship module effectively enhanced digital business creativity among learners in equality education.

Discussion

The present study examined whether a structured multimodal entrepreneurship module could enhance equality education learners' digital business creativity. The results provide strong evidence that the intervention was effective, as indicated by the substantial post-test difference between groups after controlling for baseline scores through ANCOVA. Recent research in digital entrepreneurship education (DEE) emphasizes that learning designs integrating authentic digital tasks and iterative production cycles tend to yield stronger capability outcomes than lecture-centered approaches, because they align with how opportunity recognition and value creation occur in digital contexts (Duong et al., 2024; Nguyen & Nguyen, 2024; Wibowo et al., 2023). The large practical effect observed in this study therefore reinforces current international arguments that DEE should be operationalized as competence-building through practice, not only intention-building through exposure (Duong et al., 2024; Hasan et al., 2024a).

A key contribution of this study lies in demonstrating gains across the four DBCS dimensions, indicating that multimodal entrepreneurship learning can influence digital business creativity as a multidimensional competence. Digital entrepreneurship scholarship increasingly frames creativity as an outcome of interactions among digital affordances, user feedback loops, and iterative experimentation, a dynamic that is difficult to cultivate through passive content delivery (Bejjani et al., 2023; Paul et al., 2023). In education settings, competence growth is more likely when learners engage in structured cycles of ideation, testing, and revision, supported by digital tools that enable quick prototyping and dissemination (Chen & Ifenthaler, 2023; Nguyen & Nguyen, 2024). The pattern in the current findings is consistent with this view, suggesting the module functioned as an applied creativity scaffold.

The largest improvement in the experimental group was observed in digital innovation and content creation, which require translating ideas into tangible digital outputs. This outcome is theoretically meaningful because producing content artifacts requires higher-order integration of market understanding, message design, platform logic, and technical execution, all of which are central to digital venture building (Camps et al., 2026; Paul et al., 2023). Empirical work on online practical training in digital entrepreneurship indicates that competence gains are more visible when programs emphasize doing, such as artifact creation, pitching, and reflective iteration, rather than solely conceptual instruction (Chen & Ifenthaler, 2023). In the present study, multimodal activities such as simulation-based practice and project-oriented production likely strengthened learners' capacity to generate innovative digital outputs, aligning with contemporary DEE recommendations that prioritize digital production and experimentation (Chotisarn & Phuthong, 2026; Duong et al., 2024).

The superiority of the experimental group also highlights limitations of conventional entrepreneurship instruction for equality education learners. While the control group improved modestly, this improvement may reflect general exposure to entrepreneurship concepts rather than a transformation in applied creative performance. International evidence suggests that conventional entrepreneurship education often increases awareness and readiness, yet may not consistently foster growth in advanced digital capabilities without structured practice and authentic tasks (Hasan et al., 2024b; Wibowo et al., 2023). In digital entrepreneurship, learners must develop the ability to act under uncertainty, iterate quickly, and leverage platform-based resources, and these competencies tend to emerge through guided practice and feedback rather than explanation alone (Nguyen & Nguyen, 2024; Paul et al., 2023). The present results suggest that multimodal design offered the missing mechanism by connecting conceptual entrepreneurship knowledge to applied digital performance.

Importantly, the effectiveness of the intervention must be interpreted within the context of equality education, where learners often have heterogeneous academic backgrounds and uneven digital access. Evidence from nonformal education indicates that instructional designs that diversify entry points for engagement can reduce barriers to participation and support more equitable learning trajectories (Devita, 2024; Ilyas et al., 2025). Multimodal learning, by combining visual, auditory, simulation, and project-based tasks, can provide multiple pathways to understanding and performance, potentially buffering differences in prior academic confidence. In community empowerment contexts, digital engagement interventions are also associated with improved capability adoption when learners receive structured guidance and opportunities for meaningful participation (Devita, 2024; Suparman et al., 2025). Thus, beyond creative outcomes, this study suggests that multimodal entrepreneurship learning may serve as an inclusion-oriented pedagogy suitable for equality education.

From a methodological standpoint, the use of ANCOVA strengthens the interpretation that the observed post-test differences reflect the instructional treatment rather than baseline disparities. Recent DEE studies similarly advocate rigorous designs and competence-oriented measures to move beyond intention-only outcomes and provide stronger causal evidence for instructional effectiveness (Duong et al., 2024; Nguyen & Nguyen, 2024). Moreover, systematic reviews in digital entrepreneurship highlight a field-wide need for validated competence constructs and clearer mapping between pedagogy and measurable capability outcomes (Bejjani et al., 2023; Paul et al., 2023). By applying a multidimensional scale and analyzing intervention effects with covariate control, this study responds to calls for more robust evaluation approaches in DEE research.

The findings also carry practical implications for curriculum design in equality education. International work on DEE increasingly recommends learning experiences that are project-centered, platform-relevant, and supported by guided reflection to foster transferable competencies (Chen & Ifenthaler, 2023; Chotisarn & Phuthong, 2026). In the Indonesian community education and empowerment landscape, digital transformation and digital marketing themes are gaining prominence, and programs that integrate digital practice appear aligned with empowerment-oriented

outcomes (Aliyah et al., 2024; Devita, 2024). Therefore, equality education providers may consider implementing multimodal modules that culminate in concrete digital outputs, such as product content, storefront prototypes, and marketing campaigns, and be assessed through portfolios and performance rubrics rather than only written tests (Ilyas et al., 2025; Suparman et al., 2025).

Despite the strong results, limitations should be acknowledged. The sample was limited to one regional setting, which may constrain generalizability across different equality education environments with varying infrastructure and tutor capacity. In addition, the study assessed short-term outcomes immediately following the intervention; digital entrepreneurship development typically requires sustained practice, mentoring, and ecosystem exposure to translate gains in capability into entrepreneurial action and economic outcomes (Bejjani et al., 2023; Camps et al., 2026). Future research should therefore examine longitudinal effects and include outcomes such as digital venture initiation, platform sales performance, and income indicators, while also exploring which module components contribute most strongly to each DBCS dimension (Chen & Ifenthaler, 2023; Nguyen & Nguyen, 2024).

Overall, this study demonstrates that a structured multimodal entrepreneurship module can substantially enhance equality education learners' digital business creativity. The consistent gains across DBCS dimensions, together with robust between-group differences after controlling for baseline, support multimodal pedagogy as a credible instructional innovation for nonformal entrepreneurship education. In line with the broader DEE literature, the findings suggest that competence growth in digital entrepreneurship is strengthened when learners engage in authentic, production-oriented digital tasks supported by interactive and multimodal learning pathways (Duong et al., 2024; Ilyas et al., 2025; Paul et al., 2023).

CONCLUSION

This study suggests that a structured multimodal entrepreneurship module may support the development of digital business creativity among learners in equality education. The significant differences in post-test outcomes and the large effect size indicate that the multimodal learning design was associated with positive improvements in digital ideation, innovation, content creation, and digital problem-solving. These findings extend the literature on digital entrepreneurship education by offering empirical evidence from a non-formal education context. The novelty of this study lies in its focus on Package C learners and in the integration of multimodal, experiential, and technology-based learning elements within entrepreneurship instruction. Nevertheless, given the quasi-experimental design and the limited research setting, the results should be interpreted cautiously. Further research is needed to test the effectiveness of this approach across broader contexts and with more rigorous research designs.

Practically, this study offers a scalable instructional model for Community Learning Centers and equality education programs seeking to strengthen entrepreneurial empowerment initiatives. By integrating simulation, collaborative digital tasks, and project-based learning, providers of equality education can foster measurable creative competence among learners. Future research should examine the longitudinal impact of multimodal entrepreneurship education on entrepreneurial action, digital venture sustainability, and economic empowerment outcomes to determine whether improvements in digital business creativity translate into sustained economic participation.

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