

Digital Ecosystem and Adolescent Entrepreneurial Interest: A Study of Intention among Madrasah Students in Serang

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Article History

Received on 29 May 2026

1st Revision on 09 June 2026

2nd Revision on 17 June 2026

3rd Revision on 12 July 2026

Accepted on 15 July 2026

Abstract

Purpose: This study examines the association between the digital ecosystem and entrepreneurial interest among madrasah adolescents and tests digital literacy as a mediating mechanism linking exposure to interest.

Research Methodology: A convergent mixed-methods design was applied, with a quantitative-dominant strand and a complementary qualitative strand. Data were gathered from 84 students of a state Islamic junior high school (MTsN 1) in Serang through an online five-point Likert questionnaire and two open-ended questions, then analysed using regression-based mediation with 5,000 bootstrap resamples and thematic analysis.

Results: The digital ecosystem was positively associated with entrepreneurial interest ($\beta = 0.644$) and with digital literacy ($\beta = 0.591$), and digital literacy was in turn positively associated with entrepreneurial interest ($\beta = 0.279$) after controlling for the digital ecosystem. The indirect pathway was statistically significant (95% CI [0.049, 0.319]), a pattern consistent with partial mediation, with approximately 25.6% of the total association transmitted through digital literacy; limited teacher guidance was the obstacle most frequently reported by respondents.

Conclusions: Within the limits of a cross-sectional design, digital literacy functions as a partial cognitive bridge linking ecosystem exposure and entrepreneurial aspiration; the relationships identified are statistical associations consistent with the proposed theoretical model rather than demonstrated causal effects.

Limitations: The sample was confined to a single grade level in one madrasah, and the cross-sectional design precludes causal inference.

Contributions: The study extends the Theory of Planned Behaviour to the under-researched madrasah context and offers practical direction for strengthening digital-entrepreneurship mentoring among adolescents.

Keywords: *Digital Ecosystem, Digital Literacy, Entrepreneurial Interest, Madrasah Adolescents*

How to Cite: Jawahir, M., & Rahman, A. J. (2026). Digital Ecosystem and Adolescent Entrepreneurial Interest: A Study of Intention among Madrasah Students in Serang. *Jurnal Bisnis dan Pemasaran Digital*, 6(1), 191-204.

1. Introduction

Digital transformation has reshaped the way young people first encounter the world of business ([Sari & Anggraini, 2026](#)). Long before an adolescent has ever handled capital or rented a stall, they have already watched thousands of entrepreneurial narratives unfold on screen: stories of online sellers who began from a bedroom, short-form business education content, and product showcases that scroll endlessly across the feed ([Sutejo, Rizki, Handayani, & Rinaldi, 2024](#)). The digital ecosystem, which links social media, marketplaces, and various online business platforms, now functions not merely as a channel for entertainment but as an informal learning environment that shapes adolescents' economic attitudes well before they enter the labour market ([Rosa, Pahrudin, & Koderi, 2025](#)).

Indonesia has a structural stake in this phenomenon. The national entrepreneurship ratio still lags behind that of neighbouring countries, while the demographic dividend demands a new generation of business actors drawn from the young. The government has placed considerable hope in digitalisation as a lever, targeting the migration of millions of business actors onto digital platforms ([Korpysa & Waluyohadi, 2022](#)). The difficulty is that most empirical evidence on how digital environments nurture entrepreneurial interest remains concentrated on university students ([Al-Jubari, Hassan, & Liñán, 2019](#); [Hassan, Saleem, Anwar, & Hussain, 2020](#); [Razi-ur-Rahim, Uddin, Dwivedi, & Pandey, 2024](#)). Younger cohorts, namely lower-secondary students, are almost entirely overlooked, even though it is precisely at this age that career preferences begin to take shape and digital exposure is most intense; the few studies that reach the secondary level are situated largely outside Indonesia ([Eunah, Eta, and Shepherd \(2024\)](#); ([Kakava, Eta, & Shepherd, 2024](#))).

1.1 The Research Gap, Disaggregated

Three distinct gaps motivate this study, and they are worth separating because each implies a different kind of contribution and a different standard of evidence.

1.1.1 Empirical Gap

The bulk of quantitative evidence on digital-environment associations with entrepreneurial interest has been produced with university or polytechnic samples ([Al-Jubari, Hassan, & Liñán, 2019](#); [Hassan, Saleem, Anwar, & Hussain, 2020](#); [Razi-ur-Rahim, Uddin, Dwivedi, & Pandey, 2024](#); [Akhter, Islam, Karim, & Latif, 2022](#); ([Udekwe & Iwu, 2024](#))). Lower-secondary adolescents are not a scaled-down version of that population: their occupational identity is still forming, they have limited independent transaction experience, and their exposure is mediated almost entirely through informal, entertainment-oriented platforms rather than structured entrepreneurship curricula. Extrapolating university-based coefficients to this age group is therefore an empirical leap, not a safe assumption.

1.1.2 Contextual Gap

Within Indonesia specifically, adolescent-entrepreneurship research has drawn almost exclusively on general or vocational schools ([Karyaningsih, Wibowo, Saptono, & Narmaditya, 2020](#); [Novendra, Setiani, Aryanto, & Syahpriyadi, 2024](#); [Suratno, Farida, Rosmiati, & Ari, 2020](#) ; [Sulistiyowati, Sudarwanto, Rakhmawati, Ibadil, Biantoro, Narmaditya, & Fauzi, 2024](#)), leaving the madrasah setting essentially unmapped in quantitative terms. This is not a cosmetic omission. Madrasahs combine a state-mandated academic curriculum with religious formation, and a growing qualitative literature on pesantren-based entrepreneurship education suggests that Islamic educational institutions cultivate business orientation through mechanisms that are partly distinct from secular vocational training: entrepreneurship is often framed as an extension of communal responsibility and religiously grounded self-reliance rather than purely as an individual career choice, and mentoring frequently comes from religious teachers (*ustadz/kyai*) rather than from dedicated business instructors ([Faturahman, Sulaiman, Marliani, Muhammadun, Nasikhin, & Karim, 2023](#); [Ghafar \(2023\)](#); [Cahyani, Masruri, & Hanafi, 2022](#); [Aeni, Kardeli, & Rahayu, 2023](#)). If subjective norms and the perceived legitimacy of entrepreneurship are constructed differently in this setting, the weight carried by the Theory of Planned Behaviour's components, and possibly the pathway through which digital exposure translates into interest, may also differ from what has been documented in general or vocational schools. This study is not designed to test that difference directly (a single-institution design cannot), but it is

designed to produce the first quantitative benchmark against which such comparisons can later be made.

1.1.3 Theoretical Gap

Most studies treat digital exposure as a direct predictor of entrepreneurial interest, as though watching business content in itself gives rise to aspiration. Such explanations skip over one crucial stage: the individual's capacity to process, evaluate, and use digital information, that is, digital literacy, which logically stands between exposure and interest. Several recent studies have begun to position digital competence as an intervening variable ([Abaddi, 2024](#); [Aloulou, Ayadi, Ramadani, & Dana, 2024](#); [Alzougool, 2024](#); [Tazi, 2025](#); [Pham, Do, Ha, Trinh, Le, & Tran, 2025](#)), yet none has tested it among madrasah adolescents, and, as elaborated in Section 2.3, the literature has not been consistent about where digital literacy sits within the Theory of Planned Behaviour's own architecture. The present study addresses this by positioning digital literacy as an explicit mediator and by stating, rather than leaving implicit, the theoretical role it is assumed to play.

Against this background, the study pursues three interlocking objectives. The first is to estimate the magnitude of the association between the digital ecosystem and the entrepreneurial interest of madrasah students. The second is to test whether digital literacy mediates that relationship and, at the same time, to estimate the proportion of the total association transmitted through this pathway. The third is to explore, qualitatively, the obstacles and hopes voiced by students so that the resulting recommendations rest on their own experience rather than on statistical coefficients alone. The novelty of the study lies in its combination of a rarely examined context, the explicit theoretical positioning of digital literacy as a mechanism, and a mixed-methods design that links the numbers to the respondents' own voices.

2. Literature Review and Hypotheses Development

2.1 Entrepreneurial Interest within the Theory of Planned Behaviour

Entrepreneurial interest, or intention, refers to a person's willingness and earnestness to run a business at some point in the future. Although the wider literature uses “entrepreneurial intention” and “entrepreneurial interest” close to interchangeably, this study adopts “entrepreneurial interest” consistently as the label for its own outcome construct, and reserves “intention” for instances where it refers to the terminology used in the cited literature itself. The most established framework for explaining it is the Theory of Planned Behaviour (TPB), which views intention as the outcome of attitude towards the behaviour, subjective norms, and perceived behavioural control ([Ajzen, 1991, 2020](#)). In the field of entrepreneurship, TPB has repeatedly proved robust in predicting intention across cultures and educational levels ([Liñán & Chen, 2009](#)). Recent evidence further shows that personal and situational factors shape students' intention partly through entrepreneurial self-efficacy ([Al-Qadasi et al., 2023](#)). Its strength lies in its capacity to accommodate environmental factors: exposure, information, and role models do not operate directly but instead reshape the attitudes and perceived control that eventually crystallise into intention.

The classic intention model of [Krueger et al. \(2000\)](#), rooted in the notion of the entrepreneurial event advanced by [Shapero and Sokol \(1982\)](#), complements TPB by emphasizing the roles of perceived feasibility and perceived desirability. When adolescents watch successful young entrepreneurs through social media, two things may shift at once: starting a business comes to feel both more feasible and more desirable. Taken together, these frameworks provide the theoretical grounds for treating the digital ecosystem as a source of interest formation, especially at an age when occupational identity is still fluid.

2.2 The Digital Ecosystem as an Interest-Forming Environment

The digital ecosystem is understood here as an interconnected network of social media, marketplaces, content creators, and their supporting infrastructure that enables economic activity to take place online. For adolescents, this ecosystem serves as a space for vicarious learning: they absorb norms, skills, and aspirations not from the classroom but from observing the practices displayed on screen. A number of studies in Indonesia have found that the intensity of social media use is positively

associated with entrepreneurial interest ([Maharani et al., 2023](#); [Rahmadiane & Harjanti, 2024](#)). And that visual channels such as short-video platforms are effective in introducing business models to students ([Suratno et al., 2020](#)). Evidence from transition and developed economies likewise links the digitalisation of the economy to students' entrepreneurial intention ([Ben Youssef et al., 2021](#)). Comparable evidence from other settings shows that active social-media use is significantly associated with higher entrepreneurial intention among students ([Afranie et al., 2024](#)), and that entrepreneurship education together with personality dispositions jointly shapes it ([Bans-Akutey, 2022](#)). In Indonesia, digital entrepreneurship education has likewise been associated with higher digital entrepreneurial intention through entrepreneurial alertness ([Wibowo et al., 2023, 2024](#)).

Exposure, however, is not the same as impact. A rich digital ecosystem becomes meaningful only when individuals possess the capacity to interpret it productively. From a social-learning perspective, the environment supplies the stimulus, but the learning outcome depends on the recipient's cognitive processing ([Bandura, 1997](#)). This argument leads to the first hypothesis and, at the same time, signals the need for an intervening variable.

H₁: The digital ecosystem is positively associated with students' entrepreneurial interest

2.3 Digital Literacy as a Mediator: Locating It within TPB

Digital literacy is the ability to find, evaluate, create, and use information through digital technology in a critical and responsible manner ([Gilster, 1997](#)). The concept extends beyond technical skill; it encompasses reflective judgement about the relevance and credibility of information. Before treating digital literacy as a mediator, its theoretical status relative to TPB's own architecture needs to be made explicit, because the literature has used it in at least three non-equivalent ways: (a) as a component or proxy of Perceived Behavioural Control (PBC) itself, on the reasoning that feeling digitally competent is a form of feeling capable of performing the behaviour; (b) as a cognitive antecedent that feeds into PBC and perceived feasibility without being identical to them, because PBC is a perception of ease or difficulty while digital literacy is a measured ability; and (c) as an explanatory mechanism external to the original TPB triad altogether, closer to a resource or capacity variable of the kind that self-efficacy and knowledge-based models incorporate ([Al-Qadasi et al., 2023](#); [Pham et al., 2025](#)).

This study adopts position (b). Digital literacy is treated as a cognitive antecedent that shapes the perceived feasibility of entrepreneurship rather than as a direct operationalisation of perceived behavioural control; conflating an actual capability with a perception of control would overstate what a competence measure can claim to represent. This positioning is consistent with recent work that models digital or fintech literacy as feeding into self-efficacy and outcome expectations rather than substituting for them ([Pham et al., 2025](#)), and with Indonesian evidence that digital competence and entrepreneurial knowledge operate through entrepreneurial mindset and self-efficacy as intervening mechanisms rather than as PBC itself ([Saptono et al., 2020](#); [Sutiadiningsih et al., 2025](#)).

Two theoretical relationships follow from this positioning. On the upstream side, an intensive digital ecosystem provides the practice that strengthens digital literacy: the more often adolescents interact with business platforms, the more finely honed their ability to filter and use information becomes. On the downstream side, higher digital literacy raises the perceived feasibility of entrepreneurship because individuals feel capable of operating the tools it requires, which is conceptually adjacent to, but not identical with, PBC as originally specified. Recent research supports this chain, showing that digital competence and skills are associated with entrepreneurial intention, often through intervening mechanisms such as alertness or self-efficacy ([Abaddi, 2024](#); [Aloulou et al., 2024](#); [Otache et al., 2024](#)). Consistent with this, digital literacy has been found to be associated with entrepreneurial intentions among students ([Ip, 2024](#); [Liang et al., 2025](#)), and, in the Indonesian setting, digital competence and entrepreneurial knowledge are linked to entrepreneurial intention through entrepreneurial mindset, self-efficacy, and related mechanisms ([Karyaningsih et al., 2020](#); [Sutiadiningsih et al., 2025](#)). In the Indonesian vocational context, self-efficacy has also been shown to mediate the association between entrepreneurship education and students' readiness ([Lubis et al., 2025](#)), reinforcing the plausibility of a cognitive-capacity mediator. Digital literacy is therefore

positioned not as a rival to the digital ecosystem, nor as a restatement of PBC, but as a conduit through which the ecosystem's association with interest is partly transmitted.

H₂: The digital ecosystem is positively associated with students' digital literacy

H₃: Digital literacy is positively associated with students' entrepreneurial interest

H₄: Digital literacy mediates the association between the digital ecosystem and students' entrepreneurial interest

2.4 Conceptual Framework

The four hypotheses form a simple mediation model. The digital ecosystem (X) is positioned as an exogenous variable that is associated with entrepreneurial interest (Y) both directly (path c') and indirectly through digital literacy (M) along the a–b sequence. The qualitative strand complements the model by explaining the context of obstacles and hopes that path coefficients cannot capture, in keeping with calls for research on youth entrepreneurship to move beyond numbers alone ([Chahal et al., 2024](#); [Cui & Bell, 2022](#)).

3. Research Methodology

3.1 Design

The study employed a convergent mixed-methods design with a quantitative-dominant weighting. The quantitative strand tested the mediation model in an explanatory manner, while the qualitative strand, based on thematic analysis of two open-ended questions, deepened and interpreted the numerical findings. This design rests on the premise that the phenomenon of adolescent entrepreneurial interest cannot be explained adequately through statistical magnitudes without an understanding of the experiences that underlie them.

3.2 Population, Sample, and Sampling Technique

The study population comprised the students of State Islamic Junior High School (MTsN) 1 Serang. The accessible sampling frame at the time of data collection was the Grade VIII cohort; Grades VII and IX were not included because [authors: state the scheduling/administrative reason, e.g., timetable access granted only for Grade VIII, or Grade VII/IX unavailability during the data-collection window]. Within that frame, the study followed a census logic rather than a purposive judgment sample: every Grade VIII student present and willing to participate was invited, so “purposive” here refers to the deliberate choice of the accessible grade level, not to selective inclusion of particular students within it.

Inclusion criteria were: (a) active enrolment in Grade VIII of MTsN 1 Serang during the data-collection period; (b) completion of the online questionnaire in a single sitting; and (c) provision of student assent together with parental/guardian awareness of participation (see Section 3.5). Exclusion criteria were incomplete submissions and response patterns flagged as invariant (straight-lining), which is how the sample was reduced from 85 to 84 respondents, one respondent gave an identical rating to every item, a recognised indicator of careless responding rather than genuine attitude. Sampling was therefore a purposive census within the accessible grade level, not a probability sample, and the resulting sample is not statistically representative of the wider madrasah-student population; this constraint is carried through to the limitations in Section 5.3.

The respondents were predominantly female (52 students) rather than male (32 students) and were almost entirely in Grade VIII. This concentration in a single grade level is acknowledged as a coverage limitation that constrains generalisation (see Subsection 5.3). Gender was not modelled as a covariate or tested as a moderator in the present analysis; this is a substantive omission rather than a merely descriptive one, since adolescent entrepreneurial-intention research has documented gender as one of several interacting antecedent conditions rather than as a uniform effect ([Salavou et al., 2023](#)), and vocational-context evidence shows that the strength of entrepreneurial-intention antecedents can differ specifically for female students ([Wang & Liu, 2024](#)). Because the sample is 62% female, a pooled, unweighted model risks masking a gender-specific pattern; this is flagged as a limitation in

Section 5.3 rather than corrected here, since $N = 84$ is too small to support a reliable gender-disaggregated comparison. All respondents reported having received entrepreneurship material at school; that variable was therefore not used as a predictor because it lacked variance.

3.3 Instrument and Measurement

The instrument was an online questionnaire comprising demographic-screening items, 15 five-point Likert statements (1 = strongly disagree to 5 = strongly agree), and two open-ended questions on obstacles and suggestions. Item wording was developed by adapting indicators from established entrepreneurial-intention and digital-literacy instruments ([Liñán & Chen, 2009](#); [Gilster, 1997](#)) to the madrasah adolescent context; the adapted items were reviewed by two researchers with backgrounds in education and entrepreneurship for face and content validity, and the wording was simplified for a lower-secondary reading level before fielding. The 15 items were mapped onto three constructs on the basis of this content review and subsequent empirical reliability testing: digital ecosystem (four items on exposure to business content, the school's support for digital learning, the perceived usefulness of the ecosystem, and motivation drawn from online success stories); digital literacy (four items on experience of selling online, the ease of understanding business concepts digitally, information seeking about business, and confidence in using digital media); and entrepreneurial interest (five items on interest in starting a business, possession of ideas, the desire to learn more, learning motivation, and confidence in the prospects of digital business).

Item-validity evidence was examined through Corrected Item-Total Correlations (CITC) within each hypothesised construct, using a conventional retention threshold of $\text{CITC} \geq .30$. Two items fell below this threshold and were excluded from the composite scores: one item on family support, which reflected a non-digital subjective norm rather than the digital-ecosystem construct it had been assigned to, and one item on teacher guidance, which returned a low item-total correlation with the entrepreneurial-interest construct. Both excluded items were retained as contextual descriptive information rather than discarded outright, since they later informed the qualitative interpretation in Section 4.8.

The composite score for each construct was computed as the mean of its constituent items. Internal-consistency reliability was examined using Cronbach's alpha ([Cronbach, 1951](#)), with conventional reliability thresholds drawn from [Nunnally and Bernstein \(1994\)](#); the suitability of the data for factoring was assessed through the Kaiser–Meyer–Olkin (KMO) index. Discriminant validity between constructs was evaluated through the magnitude of the intercorrelations and, for the structural-model replication, the Fornell–Larcker and heterotrait–monotrait criteria ([Fornell & Larcker, 1981](#); [Henseler et al., 2015](#)); as flagged in Section 4.3, correlation magnitude alone is a weak criterion and is treated here only as a screen against severe violation, not as confirmation of validity.

3.4 Data Analysis

The quantitative analysis proceeded in four stages: descriptive statistics and demographic profiling; examination of reliability and measurement structure; Pearson intercorrelations among constructs; and testing of the mediation model. The mediation model was tested using a hierarchical regression approach, following the logic of [Baron and Kenny \(1986\)](#) as refined by [Preacher and Hayes \(2008\)](#), by estimating path a (X to M), path b (M to Y controlling for X), the total association c (X to Y), and the direct association c' (X to Y controlling for M). The significance of the indirect association was established through a 95% bootstrap confidence interval (5,000 resamples); the association was deemed statistically significant when the interval did not include zero. Coefficients are reported in standardised form to facilitate comparison of association magnitudes.

Before interpreting the regression results, standard assumption checks appropriate to a two-predictor regression were carried out. Multicollinearity was assessed via the variance inflation factor (VIF); because X and M correlate at $r = .591$, $\text{VIF} = 1/(1 - r^2) = 1.54$, well below the conventional threshold of 5 and indicating no material collinearity problem between the two predictors of Y . Normality of residuals, homoscedasticity, and independence of residuals (Durbin–Watson) were also examined.

A further caveat concerns the bootstrap procedure itself. Simulation evidence shows that percentile bootstrap confidence intervals for indirect effects can convey 'misplaced confidence' at small-to-moderate sample sizes, with actual coverage sometimes departing from the nominal 95% level ([Koopman et al., 2015](#)). At $N = 84$, and given the moderate size of the indirect path ($a \times b = 0.165$), the sample falls short of some simulation-based sample-size recommendations for mediation models with comparable parameters ([Sim et al., 2022](#)). The significant bootstrap interval reported in Section 4.4 should therefore be read as supportive rather than definitive evidence of the indirect association, and replication with a larger sample is warranted before the mediation result is treated as established.

The regression-based mediation approach was chosen because it is transparent and replicable; its results are broadly consistent in direction with what variance-based structural equation modelling (PLS-SEM) commonly used on similar topics would be expected to produce ([Hair et al., 2022](#)), though the two approaches are not numerically interchangeable and no formal cross-validation against a PLS-SEM re-estimation was performed in this study. For further validation, criteria such as the heterotrait–monotrait ratio can be applied within PLS software ([Henseler et al., 2015](#)). The model specification for a PLS-SEM replication is provided in Appendix A as a guide for future re-estimation, not as a result already obtained.

The two open-ended questions were analysed using thematic analysis. Two coders independently read all responses and performed inductive open coding without a predefined code list; codes were then compared, discrepancies were resolved through discussion, and a shared codebook of obstacle and hope themes was developed iteratively across two rounds of comparison. A response could be assigned to more than one theme when it referenced multiple distinct obstacles or hopes; this is why the percentages reported in Section 4.5 do not sum to 100% and should be read as the proportion of respondents mentioning each theme, not as a mutually exclusive distribution. Credibility was supported through investigator triangulation (two independent coders reconciled by discussion) and an audit trail of the coding decisions; [authors: report the inter-coder agreement statistic, e.g., percentage agreement or Cohen's κ , computed before reconciliation, as a numeric agreement figure was not present in the reviewed draft]. Member-checking with respondents was not feasible given the anonymity protections described in Section 3.5, and this constraint is noted as a limitation on credibility.

3.5 Ethical Considerations

Because the respondents were minors, the study required both institutional ethical clearance and parental/guardian consent, in addition to student assent. Ethical clearance was obtained from the principal of school. Prior to data collection, the school administration distributed information about the study and a parental/guardian consent form to households; only students whose parents/guardians did not object, and who themselves gave assent, were included in the sampling frame described in Section 3.2. Respondent anonymity was preserved throughout: no directly identifying information was collected, responses were used solely for research purposes as stated in the questionnaire preamble, and only the research team had access to the raw response file. Limitations regarding the age-appropriateness of an entrepreneurial-intention instrument, which is generally validated on adult populations, are stated openly in Section 5.2.

4. Results and Discussions

4.1 Respondent Profile and Patterns of Digital Use

The respondents were active digital users. Most spent between one and six hours a day online, and some exceeded six hours. The most widely used platforms, in descending order, were WhatsApp (67 respondents), short-video platforms (64), Instagram (55), YouTube (38), and marketplaces (14). This pattern confirms that madrasah adolescents inhabit a dense digital ecosystem, although their exposure to transactional channels is far lower than to social and entertainment channels.

4.2 Reliability and Descriptive Statistics of the Constructs

Reliability should be interpreted cautiously here. Entrepreneurial interest reached an acceptable level ($\alpha = .758$), but the digital ecosystem ($\alpha = .681$) and, especially, digital literacy ($\alpha = .652$) fell below

the conventional .70 threshold (Nunnally & Bernstein, 1994). This places both predictor constructs in a marginal, exploratory-use range rather than a confirmatory-use range: coefficients in this band inflate measurement error, which in a regression context tends to attenuate observed associations rather than exaggerate them, so the true magnitude of the X–M and M–Y associations may be somewhat larger than reported, but the precision of that estimate is correspondingly lower. This is a reason for caution, not for discounting the findings, and it directly motivates the confirmatory factor analysis recommended in Section 5.4. The overall KMO index of 0.79 indicated that the data were suitable for factoring at the exploratory level. Table 1 summarises the reliability coefficients, item counts, and descriptive statistics for the three constructs.

Table 1. Reliability and descriptive statistics of the constructs

Construct	No. of items	Cronbach α	Mean	SD
Digital ecosystem (X)	4	0.681	3.53	0.63
Digital literacy (M)	4	0.652	3.17	0.79
Entrepreneurial interest (Y)	5	0.758	3.70	0.69

From Table 1, the mean for entrepreneurial interest (3.70) was relatively high, indicating a fairly strong entrepreneurial aspiration. Digital literacy, by contrast, had the lowest mean (3.17) and the widest dispersion, signaling a marked gap in ability among students. The item on experience of selling online recorded the lowest mean of all items (2.32), showing that most students remained at the stage of consumption rather than production within the digital ecosystem.

4.3 Intercorrelations among the Constructs

All constructs correlated positively and significantly. The digital ecosystem correlated most strongly with entrepreneurial interest ($r = 0.644$), followed by its correlation with digital literacy ($r = 0.591$), while digital literacy correlated with entrepreneurial interest at $r = 0.562$. All three intercorrelations fell below the 0.85 threshold conventionally used to flag severe discriminant-validity violation. This should be read narrowly: the absence of a red flag on a simple correlation criterion is not equivalent to confirmed discriminant validity, which properly requires construct-level evidence such as the Fornell–Larcker criterion or HTMT within a measurement model (Fornell & Larcker, 1981; Henseler et al., 2015). No such construct-level test was performed in the present composite-score analysis, so the claim made here is limited to the absence of evidence of severe overlap, not a positive validity claim.

4.4 Hypothesis Testing and Mediation Analysis

The regression model explained 46.6% of the variance in entrepreneurial interest ($R^2 = 0.466$). With two predictors (X and M) and $N = 84$, this corresponds to $F(2.81) = 35.34$, $p < .001$, indicating that the overall model was statistically significant. The digital ecosystem was positively and significantly associated with entrepreneurial interest, in both its total and direct associations, so H_1 was supported. The digital ecosystem also strongly predicted digital literacy (H_2 supported; the simple regression of M on X was itself significant, $F(1.82) = 43.98$, $p < .001$), and digital literacy in turn was positively associated with entrepreneurial interest, albeit with a more moderate magnitude (H_3 supported). Table 2 summarises the standardised path coefficients, their standard errors, and their approximate 95% confidence intervals ($SE = \beta/t$; $CI = \beta \pm 1.99 \times SE$, using $t_{0.95}$ for the relevant residual degrees of freedom, derived from the reported β and t statistics).

Table 2. Summary of path coefficients, standard errors and confidence intervals (standardised $N=84$)

Path	Hyp.	β	SE	95% CI	t	p	Decision
$X \rightarrow Y$ (total, c)	—	0.644	0.084	[0.476, 0.812]	7.63	< .001	—
$X \rightarrow Y$ (direct, c')	H_1	0.480	0.101	[0.279, 0.681]	4.76	< .001	Supported
$X \rightarrow M$ (a)	H_2	0.591	0.089	[0.414, 0.768]	6.64	< .001	Supported
$M \rightarrow Y X$ (b)	H_3	0.279	0.101	[0.079, 0.479]	2.77	.007	Supported

The Table 2 shows the indirect association of the digital ecosystem with entrepreneurial interest through digital literacy was 0.165 (standardised), with a 95% bootstrap confidence interval of [0.049, 0.319] that did not include zero, indicating a statistically significant indirect pathway. Because the direct association remained significant after the mediator was introduced, the pattern is one of partial mediation: digital literacy transmits part, roughly 25.6%, of the total association between the digital ecosystem and entrepreneurial interest, while most of the association continues to operate through the direct path. H_4 was therefore supported. Given the cross-sectional design, this mediation pattern should be read as statistically consistent with the hypothesised sequence (X shapes M, M shapes Y) rather than as proof that the sequence is causally ordered in that direction; a reverse or reciprocal relationship between M and Y cannot be ruled out with these data alone.

4.5 Qualitative Findings: Obstacles and Hopes

Thematic analysis of the open-ended questions added texture to the quantitative findings. Because respondents could reference more than one obstacle or hope, and coders assigned as many themes as a response substantively contained, the percentages below are the proportion of respondents mentioning each theme and do not sum to 100%. The obstacle most frequently mentioned was not technological but pedagogical: a lack of training or guidance from teachers was reported by 58% of respondents. The next most common obstacles were a lack of interest in digital business (33%), weak support from the surrounding environment (32%), limited internet access (26%), and the absence of adequate devices (11%).

On the side of hopes, the most prominent theme aligned directly with the leading obstacle. More than half of the respondents (55%) wanted training, workshops, or hands-on practice; this was followed by hopes for motivation and exposure to success stories (15%), stronger support from teachers, parents, and the school (13%), the provision of facilities and access (11%), and the establishment of digital-business programmes or extracurricular activities (10%). The respondents' voices make clear that adolescents do not lack aspiration; what they lack is the supporting structure that turns aspiration into skill.

4.6 The Digital Ecosystem as a Source of Entrepreneurial Aspiration

Support for H_1 reinforces the idea that the digital environment functions as an informal learning space associated with the formation of interest. The magnitude of the total association ($\beta = 0.644$) establishes the digital ecosystem as a substantial correlate, consistent with findings among university students and pupils in Indonesia (Maharani et al., 2023; Suratno et al., 2020) as well as across countries (Afranie et al., 2024; Aloulou et al., 2024). In the language of TPB, repeated exposure to online entrepreneurial practices and stories appears to be linked with shifts in the perceived desirability and perceived feasibility of entrepreneurship, so that aspiration grows before formal skills are acquired (Ajzen, 2020; Krueger et al., 2000); this reading is theoretically plausible but, again, not something a cross-sectional association can establish on its own. The high mean for interest alongside a lower mean for literacy underscores that desire appears to precede capacity in this sample, a pattern with pedagogical rather than causal implications.

4.7 Digital Literacy: A Genuine but Not the Sole Bridge

The partial-mediation pattern in H_4 offers a richer nuance than a simple confirmation of a direct relationship. Digital literacy proved to be a significant conduit in this model: ecosystem exposure is strongly associated with the ability to process digital information (the strong a path), and that ability in turn is associated with interest (the moderate b path). Yet the share transmitted through the mediator amounts to only a quarter of the total association, indicating that most of the ecosystem's association with interest operates through other, unmeasured mechanisms, such as shifts in affective attitude, peer-norm pressure, or inspiration from role models (Bandura, 1997; Bans-Akutey, 2022; Chahal et al., 2024).

This interpretation is consistent with the literature that treats digital competence as a partial rather than a full mediator (Abaddi, 2024; Otache et al., 2024; Pham et al., 2025). For the madrasah context, the finding is nonetheless practically encouraging because digital literacy can be developed through

instruction, there is a clear point of leverage for strengthening the chain from exposure to aspiration. The caveat is that the moderate b path implies that raising digital literacy alone would not be expected to substantially raise interest by itself; it would need to be combined with the strengthening of attitudinal and social-support dimensions ([Alzougool, 2024](#); [Chahal et al., 2024](#)), and, in future work, with entrepreneurial self-efficacy and an entrepreneurial mindset as additional mechanisms ([Lubis et al., 2025](#); [Sutiadiningsih et al., 2025](#)).

4.8 Convergence of the Quantitative and Qualitative Findings

The strength of the mixed-methods design becomes apparent at the meeting point of the two strands. The low mean for digital literacy and the frequent complaint about scant teacher guidance are consistent with one another: students inhabit an ecosystem rich in stimulus but poor in the mentoring that turns stimulus into skill. The lowest-scoring item, on experience of selling online, reinforces this reading; most adolescents remain spectators rather than participants. The dominant hope for training and hands-on practice is thus not merely a preference but a diagnosis that respondents offer of their own gap, one that also helps explain why the item on teacher guidance was excluded from the composite scores in Section 3.3: it appears to function less as a construct indicator than as a distinct, currently unmet, need. This resonates with evidence that entrepreneurship pedagogy and teacher-led experiential methods are decisive for translating exposure into intention among secondary-school students ([Eunah et al., 2024](#); [Kakava et al., 2024](#)). The finding is consistent with, rather than a correction of, prior assumptions about infrastructural barriers: in this population, the deficit in pedagogical mentoring appears more prominent than any shortage of devices, though this comparison rests on self-reported obstacle frequency rather than an independently measured infrastructure indicator.

5. Conclusions

5.1 Conclusion

This study finds that the digital ecosystem is systematically associated with the entrepreneurial interest of madrasah adolescents, and that digital literacy accounts for part of that association as a statistically supported mediating pathway. Because the design is cross-sectional, these relationships should be read as statistical associations that are consistent with the hypothesised theoretical model, not as demonstrations of causal effect; the direction assumed (exposure shapes literacy, literacy shapes interest) rests on theoretical reasoning rather than on experimental or longitudinal evidence. The partial-mediation pattern is nonetheless informative: it indicates that a simple, single-link account of the exposure–interest relationship is insufficient, since a meaningful share of the association is transmitted through a measurable cognitive pathway rather than operating in an undifferentiated way.

5.2 Research Limitations

Several limitations call for caution in interpreting the results. First, the sample was concentrated in a single grade level at one madrasah, so the findings cannot be generalised to the entire population of madrasah students and are better read as a portrait of one institution. Second, the reliability of the two predictor constructs fell within the acceptable-for-exploratory range but was not yet high, indicating that the digital-ecosystem and digital-literacy instruments still require item refinement and validation through confirmatory factor analysis. Third, the respondents were minors, whereas most entrepreneurial-intention instruments are developed and validated on adult populations; the equivalence of the constructs at this age warrants further testing. Fourth, the design was cross-sectional, so causal inferences must be avoided; the direction of association rests on theoretical logic rather than on experimental or longitudinal evidence, and every causal-sounding phrase elsewhere in this manuscript should be read subject to this constraint. Fifth, the moderate sample size limited the statistical power to detect small effects, and, per the sample-size guidance discussed in Section 3.4, fell short of some simulation-based recommendations for mediation models with comparable parameters ([Sim et al., 2022](#)).

5.3 Suggestions and Directions for Future Research

Future research is advised to broaden the coverage across grade levels and across madrasahs, to revalidate the instrument through confirmatory factor analysis and a full PLS-SEM examination with

up-to-date discriminant-validity criteria, and to add attitudinal and entrepreneurial-self-efficacy variables in order to account for the unexplained portion of the direct association (Lubis et al., 2025). With a larger sample, gender should be tested as a moderator or grouping variable rather than left as an unexamined compositional feature (Section 3.2), following evidence that entrepreneurial-intention antecedents can operate differently for female students (Wang & Liu, 2024; Salavou et al., 2023). A longitudinal or, where feasible, quasi-experimental design would be needed to support the causal claims that remain inferential in the present study, and a comparative design contrasting madrasahs with general and vocational schools would clarify whether the mediation mechanism, and the underlying subjective-norm structure discussed in Section 1, is institution-specific.

Acknowledgement

The authors thank the principal, teachers, and students of MTsN 1 Serang for their willingness to participate in this study. This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Author Contributions

MJ contributed to the conceptualization, study design, instrument development, data collection, formal analysis, and initial drafting of the manuscript. AJR contributed to the methodology, validation, interpretation of results, critical revision, and supervision. Both authors read and approved the final version of the manuscript.

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