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BIG FIVE PERSONALITY TRAITS, TECHNOLOGY ACCEPTANCE, AND ACADEMIC ENGAGEMENT IN ONLINE HIGHER EDUCATION: THE ROLE OF CONSCIENTIOUSNESS AND DIGITAL LITERACY

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Abstract:
Online and blended delivery is now a permanent feature of higher education, yet how personality, technology acceptance, and digital competence jointly shape engagement remains under-tested with primary data. This paper reports an exploratory, cross-sectional survey (N = 95) of predominantly Greek undergraduates testing an integrated model linking the Big Five traits, the Technology Acceptance Model (TAM), digital literacy, and three-dimensional academic engagement (behavioural, cognitive, emotional), focused on Conscientiousness as a personality-level predictor and digital literacy as a moderator of the personality-to-technology-acceptance pathway. Personality was measured with a Greek-language Ten-Item Personality Inventory, technology acceptance with TAM/UTAUT items, digital literacy with DigComp-aligned items, and engagement with items grounded in Fredricks, Blumenfeld and Paris's framework. Conscientiousness robustly and directly predicted all three engagement dimensions, most strongly behavioural engagement ($b = 0.41$, $p < .001$), independent of technology-acceptance beliefs. Perceived ease of use strongly predicted perceived usefulness ($b = 0.67–0.68$, $p < .001$), consistent with TAM sequencing. However, Big Five traits did not significantly predict PU/PEOU, technology-acceptance beliefs did not significantly predict engagement, and the hypothesised digital-literacy moderation was unsupported. An unanticipated positive Agreeableness–cognitive/emotional engagement association emerged. These patterns are discussed alongside instrument-reliability limitations and a key sampling feature — 70.5% of respondents had no prior online-course experience — with implications for testing this model in larger, more online-experienced samples.

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Keywords: Big Five personality traits, Technology Acceptance Model, conscientiousness, digital literacy, academic engagement

1. Introduction

Online and blended higher education has expanded sharply since COVID-19, yet access to a learning management system (LMS) does not by itself guarantee sustained engagement (Eckhaus and Davidovitch, 2021). Institutions report wide variance in participation, persistence, and satisfaction across ostensibly identical courses, even controlling for course design and instructor quality. A growing body of research attributes part of this variance to stable individual differences among learners rather than platform or pedagogy alone (Mustafa et al., 2022).

Two literatures have investigated this heterogeneity separately. Personality psychology uses the Big Five model — Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism — to explain differences in self-regulation and learning-relevant behaviour (Costa and McCrae, 1992; John and Srivastava, 1999). Information systems research uses the Technology Acceptance Model (TAM) and its successor, UTAUT, to explain technology adoption via perceived usefulness (PU) and perceived ease of use (PEOU) (Davis, 1989; Venkatesh et al., 2003). A smaller, expanding literature connects the two, showing personality can predict PU/PEOU in educational-technology contexts (Lakhal and Khechine, 2017; Mustafa et al., 2022). What remains under-examined is how a third construct — digital literacy, a learner's practical competence and confidence with digital tools (Vuorikari, Kluzer and Punie, 2022) — interacts with personality to shape technology acceptance and, in turn, engagement. Digital literacy may not be simply another predictor alongside personality, but a competency that conditions how a trait translates into behaviour.

This paper addresses that gap empirically, reporting a cross-sectional survey (N = 95) of undergraduates, predominantly in Greece, testing an integrated model in which Big Five traits — especially Conscientiousness — are hypothesised to predict academic engagement (behavioural, cognitive, emotional; Fredricks, Blumenfeld and Paris, 2004) directly and indirectly via TAM's PU/PEOU, with digital literacy moderating the personality-to-technology-acceptance pathway. The contribution is threefold: it tests, with primary data, a model usually theorised but not jointly estimated; it tests directly whether digital literacy amplifies or leaves unchanged this relationship, rather than assuming the answer; and because the sample and results depart instructively from what the literature predicts, these departures are reported transparently rather than reframed to fit the hypotheses. Section 2 develops eight hypotheses; Section 3 describes the sample, instruments, and analytic strategy; Section 4 reports results and discusses their implications; Section 5 offers recommendations for future research; Section 6 concludes.

2. Literature Review

2.1 Big Five personality traits and learning outcomes

The Five-Factor Model organises personality into Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism, each capturing stable individual differences in thought, feeling, and behaviour (Costa and McCrae, 1992; John and Srivastava, 1999). Conscientiousness — orderliness, self-discipline, goal-directed persistence — is most consistently linked to academic achievement, because it captures the self-regulatory behaviours (time management, persistence, deadline adherence) that unsupervised or asynchronous learning demands (Coenen, Borghans and Diris, 2021). Openness relates to exploratory engagement with new technologies (Mustafa et al., 2022); Neuroticism to technology anxiety and lower PEOU (Lakhal and Khechine, 2017); Extraversion and Agreeableness show more mixed, context-dependent effects (Mustafa et al., 2022; Lakhal and Khechine, 2017). Because online and blended learning places unusually heavy self-regulatory demands on students, Conscientiousness was expected a priori to be the most consequential trait for engagement here, with the remaining four retained as secondary predictors.

2.2 The Technology Acceptance Model in higher education

TAM holds that technology use is driven by perceived usefulness (belief that a system enhances performance) and perceived ease of use (belief that using it is effortless) (Davis, 1989). Its constructs were extended in UTAUT (Venkatesh et al., 2003) and applied widely to e-learning (Mustafa et al., 2022). PEOU commonly functions as an antecedent of PU — ease of use shapes perceived usefulness — a sequencing this paper's model follows.

TAM constructs are not assumed personality-neutral: more conscientious users may engage with systems more thoroughly, raising perceived usefulness, while more neurotic users may feel greater apprehension with unfamiliar interfaces, lowering PEOU (Lakhal and Khechine, 2017). This sensitivity of PU/PEOU to both system design and trait-based appraisal is the basis for treating them as mediators between personality and engagement rather than independent predictors — tested directly here rather than assumed.

2.3 Digital literacy as competency and as a moderator

Digital literacy is defined here, following the European Commission's DigComp 2.2 framework, as the competences needed to use digital technologies confidently, critically, and effectively — information literacy, communication, content creation, safety, and problem-solving (Vuorikari, Kluzer and Punie, 2022) — a learned, malleable competency distinct from stable personality traits. Two competing hypotheses are plausible. Under compensation, high digital literacy substitutes for low Conscientiousness, flattening the Conscientiousness–PEOU relationship at high literacy. Under amplification, high digital literacy strengthens this translation, because a conscientious, digitally literate student can exploit a platform's full functional range in a way a conscientious-but-unskilled student

cannot. Because UTAUT's facilitating-conditions-type variables generally act as enabling conditions that unlock a disposition's expression rather than substitutes overriding it (Lakhal and Khechine, 2017), amplification was adopted as the primary prediction, with compensation retained as a testable alternative.

2.4 Academic engagement

Academic engagement is treated as multidimensional: behavioural (participation, effort, attendance), cognitive (self-regulated learning strategies, mental effort), and emotional (interest, belonging, positive affect) (Fredricks, Blumenfeld and Paris, 2004). Conscientiousness was expected to relate most strongly to behavioural engagement; PU and PEOU to cognitive and emotional engagement.

2.5 Conceptual model and research hypotheses development

The proposed conceptual model specifies Big Five traits as exogenous predictors, PU and PEOU as parallel mediators, digital literacy as a moderator of selected paths, and the three engagement dimensions as outcomes. Figure 1 depicts this model. On this basis, the following hypotheses were tested:

- **H1**: Conscientiousness is positively associated with behavioural academic engagement, directly and independently of perceived usefulness and perceived ease of use.
- **H2**: Conscientiousness is positively associated with perceived usefulness (PU) of digital/online learning tools.
- **H3**: Conscientiousness is positively associated with perceived ease of use (PEOU) of digital/online learning tools.
- **H4**: Perceived ease of use is positively associated with perceived usefulness.
- **H5**: Perceived usefulness and perceived ease of use are each positively associated with cognitive and emotional academic engagement.
- **H6**: Neuroticism is negatively associated with perceived ease of use.
- **H7**: Openness to Experience is positively associated with perceived ease of use.
- **H8**: Digital literacy moderates the Conscientiousness→PEOU and PEOU→engagement relationships, such that these relationships are stronger among students with higher digital literacy (amplification hypothesis), with a compensation pattern retained as a plausible alternative outcome.

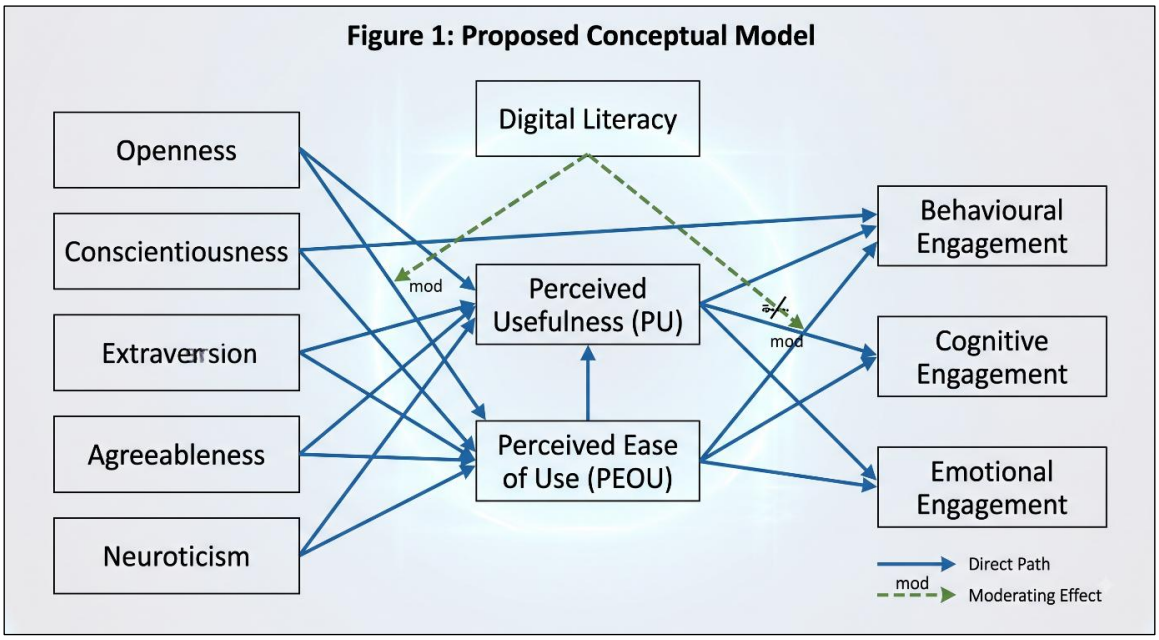

Figure 1: Proposed conceptual model

Table 1: Summary of hypotheses

Hypothesis	Relationship	Expected direction
H1	Conscientiousness → Behavioural engagement (direct)	Positive
H2	Conscientiousness → Perceived usefulness	Positive
H3	Conscientiousness → Perceived ease of use	Positive
H4	Perceived ease of use → Perceived usefulness	Positive
H5	PU, PEOU → Cognitive and emotional engagement	Positive
H6	Neuroticism → Perceived ease of use	Negative
H7	Openness → Perceived ease of use	Positive
H8	Digital literacy × Conscientiousness → PEOU; Digital literacy × PEOU → Engagement	Positive moderation (amplification); compensation retained as alternative

3. Material and Methods

This paper reports a cross-sectional, self-report online survey. The design permits associative, not causal, testing of the model. The study is best characterised as exploratory rather than confirmatory. The questionnaire was distributed via Google Forms to undergraduates in Greece utilizing convenience and snowball sampling, thus yielding 95 complete responses with no missing data (full breakdown in Table 2). The sample skewed

strongly female (82.1%), young (median age 20; M = 22.6, SD = 7.6), and toward first-year students (60.0%), predominantly at universities (90.5%) and residing in their city of study (88.4%). Self-reported GPA skewed toward the top band (63.2% in 8.5–10.0), and respondents concentrated in Education/Pedagogical Sciences (68.4%). Critically, 70.5% reported no prior online-course experience, and only 6.3% reported five-plus semesters of it.

Table 2: Sample profile (N = 95)

Variable	Category	n	%
Gender	Female	78	82.1
	Male	17	17.9
Year of study	Year 1	57	60.0
	Year 2	7	7.4
	Year 3	12	12.6
	Year 4	9	9.5
	Year 5+	10	10.5
Self-reported GPA (0–10 scale)	8.5–10.0	60	63.2
	7.0–8.4	27	28.4
	5.0–6.9	8	8.4
Employment status	Not employed	50	52.6
	Part-time	28	29.5
	Full-time	17	17.9
Institution type	University	86	90.5
	Other (military/police academy, college, vocational)	9	9.5
Prior online-course experience	None	67	70.5
	1–2 semesters	8	8.4
	3–4 semesters	14	14.7
	5+ semesters	6	6.3
Faculty / field	Education / Pedagogical Sciences	65	68.4
	Humanities & Social Sciences	11	11.6
	Natural & Technological Sciences	10	10.5
	Economics & Business Administration	5	5.3
	Health Sciences	2	2.1
	Other	2	2.1

All constructs were measured on 5-point Likert scales (1 = strongly disagree, 5 = strongly agree), using items constructed specifically for this study and grounded conceptually in established frameworks.

- **Big Five personality traits:** ten items after the Ten-Item Personality Inventory (TIPI; Gosling, Rentfrow and Swann, 2003), two per trait (one straight-, one reverse-worded, except Neuroticism, scored from two positively worded stability items reverse-coded). TIPI trades reliability for breadth and brevity, revisited with the Section 4.1 alpha coefficients.
- **Perceived usefulness (PU):** four items adapted from Davis (1989) and Venkatesh et al. (2003), on whether digital learning tools and online education would improve academic performance, flexibility, and productivity.

- **Perceived ease of use (PEOU):** two items adapted from Davis (1989) and Venkatesh et al. (2003), on comfort with, and anticipated ease of, using online platforms.
- **Digital literacy:** eight items aligned with DigComp 2.2 competence areas (Vuorikari, Kluzer and Punie, 2022): comfort with digital tools, ease of learning new tools, critical evaluation of online information, and their integration into daily study.
- **Academic engagement:** grounded in Fredricks, Blumenfeld and Paris (2004). Behavioural engagement (5 items): attendance, participation, timely completion; cognitive engagement (5 items): self-regulated learning (goal-setting, monitoring, time management, strategy use); emotional engagement (5 items): intrinsic motivation plus sense of belonging.

The questionnaire additionally included UTAUT social-influence and facilitating-conditions items, a metacognition sub-scale, and scales for self-efficacy, satisfaction, procrastination, anxiety, and social desirability, collected as part of a broader instrument. These are not central to the hypotheses tested here and are used only in supplementary description or flagged for future secondary analysis. Composite scores were averaged (reverse-scored where applicable) item responses per construct; internal consistency was assessed via Cronbach's alpha (Cronbach, 1951) and common method bias via Harman's single-factor test (Podsakoff et al., 2003). Descriptive statistics and Pearson correlations were computed first. Hypotheses were then tested with OLS multiple regression rather than the SEM originally envisaged: with N = 95 and multiple predictors, the sample did not meet conventional guidance for stable SEM estimation (Hair et al., 2019), so hierarchical and moderated regression was used instead (Aiken and West, 1991; Hayes, 2018). Moderation (H8) was tested by mean-centring predictors and entering their product term (Aiken and West, 1991).

Participation was voluntary and anonymous; informed consent was obtained on the survey's introductory page before access was granted, and no directly identifying information was collected.

4. Results and Discussion

4.1 Reliability and Descriptive Statistics

Table 3 reports Cronbach's alpha and descriptive statistics. Reliability was good to excellent for PU (α = .90), digital literacy (α = .81), and cognitive engagement (α = .83), acceptable for PEOU (α = .70) and behavioural engagement (α = .68), and marginal for emotional engagement (α = .58). As anticipated given TIPI's brevity-over-reliability design (Gosling, Rentfrow and Swann, 2003), the two-item Big Five sub-scales were consistently weak: Neuroticism α = .63, Extraversion α = .49, Conscientiousness α = .31, Agreeableness α = .19, Openness α = –.17 (essentially uncorrelated items). This is a material limitation for any Big-Five-related result (Section 4.8), and a plausible statistical explanation, alongside substantive ones, for the largely null findings below.

Table 3: Reliability and descriptive statistics for main study variables (N = 95)

Variable	Items	Cronbach's α	Mean	SD	Min	Max
Conscientiousness	2	0.31	3.57	0.70	2.0	5.0
Extraversion	2	0.49	3.23	0.78	1.5	5.0
Agreeableness	2	0.19	3.41	0.61	2.0	5.0
Neuroticism	2	0.63	3.20	0.87	1.0	5.0
Openness	2	-0.17	3.45	0.75	1.5	5.0
Perceived usefulness (PU)	4	0.90	3.43	0.89	1.0	5.0
Perceived ease of use (PEOU)	2	0.70	3.74	0.83	1.0	5.0
Digital literacy	8	0.81	3.74	0.65	2.0	5.0
Behavioural engagement	5	0.68	3.58	0.71	1.6	4.8
Cognitive engagement	5	0.83	3.37	0.80	1.4	5.0
Emotional engagement	5	0.58	3.56	0.60	1.8	4.8

Note: Scale range 1–5. Neuroticism alpha was computed on the two emotional-stability items prior to reverse-scoring.

Harman's single-factor test across all 39 items entering the Big Five, PU/PEOU, digital literacy, and engagement composites yielded a first unrotated factor explaining 17.7% of variance - well below the 50% concern threshold (Podsakoff et al., 2003) - some reassurance that the single-source design did not produce a dominant common-method artefact.

4.2 Correlations among study variables

Table 4 reports bivariate correlations. Conscientiousness correlated significantly with all three engagement dimensions - behavioural ($r = .39$, $p < .001$), cognitive ($r = .31$, $p = .002$), emotional ($r = .23$, $p = .026$) - but not with PU ($r = –.17$, $p = .095$) or PEOU ($r = .04$, $p = .684$). PU and PEOU correlated strongly with each other ($r = .63$, $p < .001$) and with digital literacy ($r = .61$, $.76$, both $p < .001$), but neither correlated significantly with any engagement dimension (all $|r| \leq .15$, $p > .10$). Agreeableness, not hypothesized as central, correlated significantly with cognitive ($r = .28$, $p = .006$) and emotional engagement ($r = .23$, $p = .025$). Neuroticism and Openness were not significantly correlated with PEOU ($r = –.08$, $r = –.11$, n.s.), contrary to H6 and H7.

Table 4: Bivariate correlations among main study variables (N = 95)

	1	2	3	4	5	6	7	8	9	10	11
1. Consc.	—	-.07	.10	-.06	-.11	-.17	.04	.05	.39***	.31**	.23*
2. Extra.		—	-.03	-.09	.30**	-.05	-.02	.03	.19	-.02	.13
3. Agree.			—	-.11	.26*	-.05	-.05	.02	.15	.28**	.23*
4. Neuro.				—	-.00	.04	-.08	-.05	-.02	.13	-.14
5. Open.					—	-.10	-.11	.00	.10	.11	.01
6. PU						—	.63***	.61***	-.13	-.00	.03
7. PEOU							—	.76***	-.08	.02	.15
8. DL								—	-.06	.16	.10
9. BehEng									—	.34***	.34***
10. CogEng										—	.46***
11. EmoEng											—

Note: Consc. = Conscientiousness, Extra. = Extraversion, Agree. = Agreeableness, Neuro. = Neuroticism, Open. = Openness, DL = Digital literacy, BehEng/CogEng/EmoEng = Behavioural/Cognitive/Emotional engagement. * p < .05, ** p < .01, *** p < .001 (two-tailed).

4.3 Regression tests of H2, H3, H4, H6, and H7: personality, PEOU, and PU

With all five Big Five traits entered simultaneously, the model predicting PU was not significant (R^2 = .045, adjusted R^2 = –.008, F(5,89) = 0.84, p = .522); Conscientiousness showed a negative, marginally significant coefficient (b = –0.23, p = .084) — opposite to H2. The PEOU model was also not significant (R^2 = .020, adjusted R^2 = –.035, F(5,89) = 0.37, p = .871): Neuroticism's coefficient was directionally negative but far from significant (b = –0.08, p = .453), and Openness's was, contrary to H7, negative rather than positive (b = –0.11, p = .383). H2, H3, H6, and H7 were therefore not supported. H4 was clearly supported: PEOU significantly predicted PU alone (b = 0.67, SE = 0.09, t = 7.89, p < .001, R^2 = .401) and with the full Big Five as controls (b = 0.68, SE = 0.09, t = 8.06, p < .001, R^2 = .451, adjusted R^2 = .413, F(6,88) = 12.03, p < .001). In this fuller model Conscientiousness's association with PU became significant and negative (b = –0.26, SE = 0.10, t = –2.52, p = .013) — a suppression-type pattern revealing a unique negative association invisible in the simple correlation.

Table 5: Regression models predicting technology acceptance from Big Five traits

Predictor	DV: PU (Big Five only)	DV: PEOU (Big Five only)	DV: PU (+ PEOU)
Conscientiousness	-0.23 (p=.084)	0.03 (p=.782)	-0.26* (p=.013)
Extraversion	-0.03 (p=.811)	0.00 (p=.971)	-0.03 (p=.730)
Agreeableness	-0.01 (p=.966)	-0.04 (p=.778)	0.02 (p=.853)
Neuroticism	0.03 (p=.800)	-0.08 (p=.453)	0.08 (p=.333)
Openness	-0.13 (p=.334)	-0.11 (p=.383)	-0.05 (p=.603)
PEOU	—	—	0.68*** (p<.001)
R^2 (Adj. R^2)	.045 (-.008)	.020 (-.035)	.451 (.413)
F	0.84, p=.522	0.37, p=.871	12.03, p<.001

Note: Unstandardised coefficients (b). N = 95. * p < .05, ** p < .01, *** p < .001.

4.4 Regression tests of H1 and H5: predicting academic engagement

H1 was supported. With Conscientiousness, PU, and PEOU entered simultaneously, Conscientiousness remained the dominant significant predictor of behavioural engagement ($b = 0.41$, $SE = 0.10$, $t = 4.01$, $p < .001$), while neither PU ($b = 0.00$, $p = .976$) nor PEOU ($b = –0.09$, $p = .433$) contributed significantly ($R^2 = .164$, adjusted $R^2 = .136$, $F(3,91) = 5.95$, $p < .001$). Since PU and PEOU were themselves unrelated to Conscientiousness (Section 4.3), this indicates a direct, non-mediated relationship rather than one operating through technology-acceptance beliefs.

H5 was not supported: PU and PEOU jointly failed to predict cognitive engagement ($R^2 < .001$, $F(2,92) = 0.02$, $p = .980$) or emotional engagement ($R^2 = .028$, $F(2,92) = 1.33$, $p = .270$), though PEOU's coefficient for the latter was directionally positive and largest ($b = 0.15$, $SE = 0.10$, $t = 1.60$, $p = .114$).

Table 6: Regression models predicting academic engagement dimensions

Predictor	DV: Behavioural engagement	DV: Cognitive engagement	DV: Emotional engagement
Conscientiousness	0.41*** (p<.001)	—	—
PU	0.00 (p=.976)	-0.02 (p=.895)	-0.07 (p=.454)
PEOU	-0.09 (p=.433)	0.03 (p=.843)	0.15 (p=.114)
R^2 (Adj. R^2)	.164 (.136)	.000 (-.021)	.028 (.007)
F	5.95, p<.001	0.02, p=.980	1.33, p=.270

Note: Unstandardised coefficients (b). N = 95. *** p < .001. Behavioural-engagement model also includes Conscientiousness as tested in H1; Cognitive and Emotional models test H5 (PU, PEOU only, per hypothesis).

Exploratory models adding the full Big Five and digital literacy alongside PU and PEOU (not tabulated) did not alter the PU/PEOU conclusions, but surfaced two unanticipated predictors: Extraversion for behavioural engagement ($b = 0.20$, $p = .032$) and, more notably, Agreeableness for cognitive ($b = 0.31$, $p = .020$) and emotional engagement ($b = 0.23$, $p = .030$). Digital literacy showed a marginal, non-significant positive association with cognitive engagement ($b = 0.36$, $p = .059$).

4.5 Moderation test of H8: digital literacy

H8 was not supported. Predicting PEOU from mean-centred Conscientiousness, digital literacy, and their interaction, digital literacy was (unsurprisingly, given its strong correlation with PEOU) a large, highly significant main effect ($b = 0.96$, $p < .001$, $R^2 = .576$), but the Conscientiousness × Digital Literacy interaction was not significant ($b = 0.10$, $p = .472$). Predicting composite engagement from mean-centred PEOU, digital literacy, and their interaction, the overall model was not significant ($R^2 = .032$, $p = .389$), nor was the interaction term ($b = 0.11$, $p = .168$).

An exploratory, dimension-specific check found a significant PEOU × Digital Literacy interaction for behavioural engagement alone ($b = 0.24$, $SE = 0.11$, $t = 2.23$, $p = .028$), but the overall model was itself not significant ($R^2 = .058$, $F(3,91) = 1.86$, $p = .141$). This isolated term within a non-significant omnibus model is reported for transparency

but not interpreted as reliable evidence for H8 - a hypothesis-generating signal for future, adequately powered replication rather than support for amplification.

Table 7: Moderated regression tests of digital literacy (H8)

Predictor	DV: PEOU (H8a)	DV: Engagement composite (H8b)
Conscientiousness (centred)	0.01 (p=.951)	—
PEOU (centred)	—	0.00 (p=.997)
Digital literacy (centred)	0.96*** (p<.001)	0.12 (p=.347)
Interaction term	0.10 (p=.472)	0.11 (p=.168)
R^2 (Adj. R^2)	.576 (.562)	.032 (.001)
F	41.12, p<.001	1.02, p=.389

Note: Unstandardized coefficients (b), mean-centered predictors. N = 95. *** p < .001.

4.6 Summary of hypothesis tests

Table 8 shows the summary of hypothesis testing outcomes.

Table 8: Summary of hypothesis testing outcomes

Hypothesis	Result	Key statistic
H1: Conscientiousness → Behavioural engagement (direct)	Supported	b=0.41, p<.001
H2: Conscientiousness → PU	Not supported (trend opposite)	b=-0.23, p=.084
H3: Conscientiousness → PEOU	Not supported	b=0.03, p=.782
H4: PEOU → PU	Supported	b=0.67–0.68, p<.001
H5: PU, PEOU → Cognitive/Emotional engagement	Not supported	all p>.10
H6: Neuroticism → PEOU (negative)	Not supported (directionally consistent, n.s.)	b=-0.08, p=.453
H7: Openness → PEOU (positive)	Not supported (opposite trend, n.s.)	b=-0.11, p=.383
H8: Digital literacy moderation	Not supported	interaction p=.472 / p=.168

5. Discussion & Conclusions

5.1 Discussion

The clearest, most robust finding was that Conscientiousness predicted every engagement dimension directly rather than through technology-acceptance beliefs - consistent with the personality–achievement literature's emphasis on Conscientiousness as the trait most tied to the self-regulatory behaviours (attendance, timely completion, persistence) that sustain engagement (Coenen, Borghans and Diris, 2021). This held despite Conscientiousness being measured with only two modestly reliable items (α = .31); if anything, this unreliability should have attenuated the association, suggesting the true relationship could be even stronger in a better-measured sample.

The second robust finding - PEOU strongly predicting PU (H4) - replicates one of the most consistent relationships in the TAM literature (Davis, 1989; Venkatesh et al., 2003), holding even with little direct online-learning experience, suggesting the belief that 'easy' tools are also 'useful' ones does not require extensive prior use.

By contrast, H2, H3, H6, H7, H5, and H8 were not supported. Three non-exclusive explanations are worth weighing. Substantively, 70.5% of respondents had no prior

online-course experience, so the PU/PEOU items necessarily captured anticipated, hypothetical beliefs rather than reports grounded in sustained use, while the engagement items - especially behavioural engagement - were anchored in in-person participation; a belief about an unused technology may simply be decoupled from behaviour in largely face-to-face courses. Statistically, the weak-to-negative reliability of the two-item Big Five sub-scales would attenuate any true association and reduce power to detect it. Theoretically, beliefs about a not-yet-adopted tool may genuinely not yet translate into current engagement, only doing so once actual use begins - a boundary condition this cross-sectional design cannot adjudicate.

The unanticipated positive Agreeableness–cognitive/emotional engagement association is worth noting rather than dismissing as noise, since it survived in a fuller model alongside Conscientiousness, PU, PEOU, and digital literacy. This is broadly consistent with evidence that Agreeableness relates positively to appraisals of collaborative, supportive environments (Lakhal and Khechine, 2017), and may reflect agreeable students' inclination toward the cooperative, community-oriented behaviours several engagement items captured. Not hypothesised in advance, this pattern should be treated as exploratory.

Two practical implications follow cautiously. First, since Conscientiousness's link to engagement was direct rather than routed through technology-acceptance beliefs, interventions aimed at engagement via digital-tool adoption alone may not be the most direct lever for less self-regulated students; structural scaffolding aimed at behaviour directly (reminders, checkpoints, deadlines) may be more proportionate. Second, the absent digital-literacy moderation does not support prioritising digital-skills training as a mechanism for converting personality into technology acceptance here; digital literacy's very strong direct association with PEOU (b = .96, Table 7) suggests the two constructs may be closely related, even overlapping, in this population — a useful lesson for future instrument development.

5.2 Limitations

Several limitations qualify these findings. The convenience sample skewed toward female (82.1%), first-year (60.0%), Education-faculty (68.4%) students with little online-course experience, limiting generalizability - especially to students with substantial genuine online-learning experience, the population the title and motivating literature most directly concern. N = 95 is modest relative to the predictors examined and precluded the originally envisaged SEM; OLS regression, an appropriate substitute at this size (Aiken and West, 1991; Hayes, 2018), estimates composite- rather than latent-level relationships and does not correct for measurement error as SEM would. Several personality sub-scales showed weak (Conscientiousness α = .31, Extraversion α = .49) to negative (Openness α = –.17, Agreeableness α = .19) reliability, a known trade-off of ultra-brief measures like the TIPI (Gosling, Rentfrow and Swann, 2003), though toward the low end even for that instrument type — conclusions about Openness particularly warrant strong caution. Items were study-specific and conceptually, not identically, grounded in

published scales; replication with validated instruments (e.g., BFI-2-S; Soto and John, 2017) would strengthen confidence. The cross-sectional, self-report design cannot establish causal direction and carries residual common-method risk, though Harman's test was reassuring (17.7% first-factor variance; Podsakoff et al., 2003). Self-reported GPA skewed toward the top band, a familiar self-report/self-selection pattern possibly reflecting the sample's concentration in one faculty and year.

5.3 Recommendations for future research

Future research should prioritise: (1) replication in a larger, more diverse sample, ideally with quota sampling on gender, year, and faculty; (2) recruitment targeting students with substantial genuine online/blended experience, to test whether the null technology-acceptance findings reflect limited online exposure rather than the underlying model; (3) longer, validated personality instruments (e.g., BFI-2-S; Soto and John, 2017) for reliable trait scores, particularly for Openness and Agreeableness; (4) a longitudinal or pre/post design bracketing actual technology adoption, testing whether technology-acceptance beliefs predict engagement once real use occurs; and (5) analysis of constructs collected but not modelled here - self-efficacy (Bandura, 1997), procrastination (Tice and Baumeister, 1997), academic anxiety, belonging, and social desirability - which may explain further variance and clarify whether the Agreeableness finding replicates.

5.4. Conclusions

This paper tested an integrated model linking Big Five traits, TAM, digital literacy, and three-dimensional academic engagement. Conscientiousness emerged as a robust, direct predictor of all three engagement dimensions, independent of technology-acceptance beliefs, and PEOU strongly predicted PU, replicating core TAM sequencing. Against expectation, personality traits did not significantly predict technology-acceptance beliefs, those beliefs did not significantly predict engagement, and digital literacy did not significantly moderate the personality-to-technology-acceptance pathway; an unanticipated Agreeableness–cognitive/emotional engagement association emerged instead. These patterns most plausibly reflect limited online-learning experience, modest reliability of the brief personality measures, and genuine sample-specific dynamics that larger, more targeted replications are needed to disentangle. Rather than reframing results to fit the hypotheses, they are reported as obtained: a transparent account of where an integrated model does and does not hold is of more value than a tidier but less honest narrative.

Conflict of Interest Statement
The authors declare no conflicts of interest.

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References

Aiken LS, West SG, 1991. Multiple Regression: Testing and Interpreting Interactions. Newbury Park, CA, USA: Sage. Retrieved from https://books.google.ro/books/about/Multiple_Regression.html?id=LcWLUyXcmnkC&redir_esc=y

Bandura A, 1997. Self-Efficacy: The Exercise of Control. New York, USA: W.H. Freeman. Retrieved from https://psycnet.apa.org/record/1997-08589-000

Coenen J, Borghans L, Diris R, 2021. Personality traits, preferences and educational choices: a focus on STEM. Journal of Economic Psychology 84: 102361. https://doi.org/10.1016/j.joep.2021.102361

Costa PT, McCrae RR, 1992. Revised NEO Personality Inventory (NEO-PI-R) and NEO Five-Factor Inventory (NEO-FFI) Professional Manual. Odessa, FL, USA: Psychological Assessment Resources. Retrieved from https://www.researchgate.net/publication/240133762_Neo_PI-R_professional_manual

Cronbach LJ, 1951. Coefficient alpha and the internal structure of tests. Psychometrika 16(3): 297-334. Retrieved from https://doi.org/10.1007/BF02310555

Davis FD, 1989. Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly 13(3): 319-340. https://doi.org/10.2307/249008

Devaraj S, Easley RF, Crant JM, 2008. How does personality matter? Relating the five-factor model to technology acceptance and use. Information Systems Research 19(1): 93-105. https://doi.org/10.1287/isre.1070.0153

Eckhaus E, Davidovitch N, 2021. Driving value creation in the new economy following the COVID-19 crisis. Data-mining students' satisfaction from online teaching in the virtual academic climate. Electronic Journal of e-Learning 19(5): 452-468. https://files.eric.ed.gov/fulltext/EJ1328929.pdf

Fredricks JA, Blumenfeld PC, Paris AH, 2004. School engagement: Potential of the concept, state of the evidence. Review of Educational Research 74(1): 59-109. https://doi.org/10.3102/00346543074001059

Gosling SD, Rentfrow PJ, Swann WB, 2003. A very brief measure of the Big-Five personality domains. Journal of Research in Personality 37(6): 504-528. https://doi.org/10.1016/S0092-6566(03)00046-1

Hair JF, Black WC, Babin BJ, Anderson RE, 2019. Multivariate Data Analysis, 8th edn. Andover, UK: Cengage. Retrieved from https://books.google.ro/books/about/Multivariate_Data_Analysis.html?id=0R9ZswEACAAJ&redir_esc=y

Hayes AF, 2018. Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach, 2nd edn. New York, USA: Guilford Press. Retrieved from https://books.google.ro/books/about/Introduction_to_Mediation_Moderation_and.html?id=MglQEAAAQBAJ&redir_esc=y

John OP, Srivastava S, 1999. The Big Five trait taxonomy: History, measurement, and theoretical perspectives. In: Pervin LA, John OP (eds.) Handbook of Personality: Theory and Research, 2nd edn. New York, USA: Guilford Press, pp 102-138. Retrieved from https://psycnet.apa.org/record/1999-04371-004

Khechine H, Lakhal S, Ndjambou P, 2016. A meta-analysis of the UTAUT model: Eleven years later. Canadian Journal of Administrative Sciences 33(2): 138-152. Retrieved from https://doi.org/10.1002/cjas.1381

Khechine H, Lakhal S, Pascot D, Bytha A, 2014. UTAUT model for blended learning: The role of gender and age in the intention to use webinars. Interdisciplinary Journal of E-Learning and Learning Objects 10: 33-52. https://doi.org/10.28945/1994

Lakhal S, Khechine H, 2017. Relating personality (Big Five) to the core constructs of the Unified Theory of Acceptance and Use of Technology. Journal of Computers in Education 4(3): 251-282. https://doi.org/10.1007/s40692-017-0086-5

Lakhal S, Frenette E, Sevigny S, Khechine H, 2012. Relationship between choice of a business major type (thing-oriented versus person-oriented) and Big Five

personality traits. International Journal of Management Education 10(2): 88-100. Retrieved from https://doi.org/10.1016/j.ijme.2012.03.003

Mustafa S, Qiao Y, Yan X, Anwar A, Hao T, Rana S, 2022. Digital students' satisfaction with and intention to use online teaching modes, role of Big Five personality traits. Frontiers in Psychology 13: 956281. Retrieved from https://doi.org/10.3389/fpsyg.2022.956281?urlappend=%3Futm_source%3Dresearchgate.net%26utm_medium%3Darticle

Podsakoff PM, MacKenzie SB, Lee JY, Podsakoff NP, 2003. Common method biases in behavioral research: A critical review of the literature and recommended remedies. Journal of Applied Psychology 88(5): 879-903. Retrieved from https://doi.org/10.1037/0021-9010.88.5.879

Soto CJ, John OP, 2017. The next Big Five Inventory (BFI-2): Developing and assessing a hierarchical model with 15 facets to enhance bandwidth, fidelity, and predictive power. Journal of Personality and Social Psychology 113(1): 117-143. https://doi.org/10.1037/pspp0000096

Svendsen GB, Johnsen JAK, Almas-Sorensen L, Vitterso J, 2013. Personality and technology acceptance: the influence of personality factors on the core constructs of the Technology Acceptance Model. Behaviour & Information Technology 32(4): 323-334. https://doi.org/10.1080/0144929X.2011.553740

Tice DM, Baumeister RF, 1997. Longitudinal study of procrastination, performance, stress, and health: The costs and benefits of dawdling. Psychological Science 8(6): 454-458. https://doi.org/10.1111/j.1467-9280.1997.tb00460.x

Venkatesh V, Morris MG, Davis GB, Davis FD, 2003. User acceptance of information technology: Toward a unified view. MIS Quarterly 27(3): 425-478. https://doi.org/10.2307/30036540

Vuorikari R, Kluzer S, Punie Y, 2022. DigComp 2.2: The Digital Competence Framework for Citizens. Luxembourg: Publications Office of the European Union. Retrieved from https://publications.jrc.ec.europa.eu/repository/handle/JRC128415