Digital Stress and the Relationship Between Perceived New Media Literacy and Anxiety Symptoms Among Art Undergraduates

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ABSTRACT

Digital competence may help students navigate information and creative work while coexisting with pressure to remain connected and respond to others. This cross-sectional study examined perceived new media literacy, digital stress, and anxiety symptoms among art undergraduates in Hunan, China. Of 496 returned questionnaires, 482 remained after initial screening. Excluding 57 responses invariant across all 72 core questionnaire items yielded an analytic sample of 425 students. Observed-score ordinary least squares models used HC3 robust standard errors and 10,000 respondent-level bootstrap resamples. Perceived literacy had a negative total association with anxiety symptoms, b = −0.03355, 95% CI [−0.06153, −0.00558]. Literacy was positively associated with digital stress, which was positively associated with anxiety conditional on literacy. The positive indirect association, ab = 0.02441, 95% bootstrap CI [0.01023, 0.03847], opposed the negative direct association, b = −0.05796, 95% CI [−0.08075, −0.03518]. The fully standardized indirect estimate was 0.1037, 95% bootstrap CI [0.0426, 0.1662]. Together, literacy and stress accounted for 27.41% of anxiety-score variance. The findings identify an opposing pattern of concurrent associations and suggest that perceived digital competence and experienced digital demands warrant joint consideration in art education. Longitudinal research is needed to evaluate their temporal relationships.

Keywords — perceived new media literacy, digital stress, anxiety symptoms, art undergraduates, indirect association

INTRODUCTION

Art students increasingly use digital environments to find references, develop creative work, collaborate, and present themselves to audiences. These activities call for more than technical proficiency. Students must evaluate sources, understand how messages are constructed, and make decisions about producing and circulating content. At the same time, participating in digitally connected study can involve expectations about availability, audience response, and continuing attention. Understanding students' psychological experiences therefore requires attention to both their perceived capabilities and the demands they experience.

New media literacy provides a communication perspective on those capabilities. Lin et al. (2013) distinguish functional and critical capacities across consumption and prosumption. Koc and Barut (2016) subsequently developed a multidimensional measure for university students. Within this approach, literacy encompasses interpreting and evaluating media as well as producing and sharing content. These capacities could support a sense of control when students encounter complex information or communication tasks. In this study, however, the predictor captures students' assessments of their own competence. Hargittai and Shafer (2006) demonstrate why perceived online skills should be distinguished from demonstrated performance.

The connection between literacy and anxiety becomes more complicated when participation itself carries demands. Digital stress encompasses availability stress, approval anxiety, fear of missing out, connection overload, and online vigilance (Steele et al., 2020; Hall et al., 2021). A student who feels competent may still worry about a delayed reply or an audience's response. Skills may coexist with demanding communication practices. This raises a question for communication education about how perceived competence relates to symptoms when digital stress is considered alongside it.

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Existing research on digital media and mental health provides context for this question, although its exposures differ from perceived literacy. Vannucci et al. (2017) examined social media use and anxiety in emerging adulthood. Burke and Kraut (2016) showed the importance of communication type and relationship strength for well-being. These studies encourage closer attention to what people do and experience in digital environments. They also leave room to examine whether perceived capabilities and perceived pressure contribute differently to the same psychological outcome.

The present article focuses on anxiety symptoms among art undergraduates in Hunan, China. It examines the total literacy–anxiety association and the indirect statistical association through digital stress. The article is a focused analysis of a wider questionnaire that also measured depressive symptoms. Its contribution is to examine whether perceived literacy and digital stress reveal opposing components within the overall literacy–anxiety relationship. Because the measures were collected concurrently, the estimates describe differences between students at one time point.

2 Conceptual background and research questions

2.1 Perceived new media literacy and anxiety symptoms

For creative students, consuming and producing media can form part of the same task. Evaluating a source may inform a design decision, while sharing a draft can create opportunities for feedback and revision. The framework of Lin et al. (2013) connects these activities through functional and critical literacy. Perceived capacity to evaluate information and act purposefully could be associated with less uncertainty in digitally mediated study. This provides a rationale for examining an inverse relationship between perceived literacy and anxiety symptoms.

The interpretation depends on what the literacy questionnaire measures. Self-reported skills may reflect confidence and perceived control alongside competence. A student's current emotional state could also influence how capable they feel. Consequently, an inverse association would concern perceived literacy within this sample. The study does not directly evaluate the psychological consequences of acquiring an objectively measured skill.

H1 predicts that perceived new media literacy is negatively associated with anxiety symptoms in the total-association model.

2.2 Digital stress as a proposed intervening construct

Digital stress concerns the pressure associated with connection and participation. Hall et al. (2021) operationalised five components that include expectations about responding, concern about approval, and continuing awareness of online activity. Student telepressure similarly involves a preoccupation with responding promptly across communication contexts (Barber & Santuzzi, 2017). These accounts explain why technical facility alone may leave some demands unresolved. The perceived capacity to communicate and the perceived freedom to delay communication are distinct experiences.

The literacy–stress relationship can plausibly take different directions. Perceived competence could accompany lower stress when students feel able to manage communication. It could also accompany higher stress if confident students undertake more visible work, coordinate more exchanges, or become more aware of digital demands. The latter explanations concern participation and appraisal, which were not directly measured here. The analysis therefore estimates the direction of the relationship empirically.

Chinese validation studies also support attending closely to the operational meaning of digital stress. Zhang et al. (2023) evaluated a 24-item Chinese version and developed a short form. Lao et al. (2023) reported a revised 31-item adaptation containing an additional social comparison dimension. Their findings establish relevant measurement precedents while requiring the administered version and its performance to be specified in each study.

RQ1 asks whether perceived new media literacy has a non-zero indirect statistical association with anxiety symptoms through digital stress, and whether its sign agrees with or opposes the direct association. When the

direct and indirect components have opposite signs, Zhao et al. (2010) describe the pattern as competitive mediation. Here, that terminology identifies the fitted decomposition. Maxwell and Cole (2007) show why concurrent mediation estimates require caution when interpreted as evidence of a temporal process.

2.3 Analytical framework

The framework specifies perceived new media literacy as X, digital stress as M, and anxiety symptoms as Y. The total association links X with Y before M enters the outcome equation. The direct association links X with Y conditional on M, while the indirect association is the product of the X–M and conditional M–Y coefficients. This structure allows the overall literacy–anxiety association to be examined alongside a stress-related component. Demographic characteristics describe the sample in this focused article.

3 Methods

3.1 Design and participants

Eligible participants were undergraduates in art-related programmes in Hunan Province, China, who could understand the questionnaire and agreed to participate voluntarily. Recruitment used quota-guided convenience sampling through educational settings, institutional contacts, and online and offline questionnaire distribution. The intended male-to-female recruitment ratio was approximately 30:70. The achieved sample had a higher proportion of women, and analyses were unweighted.

The study targeted approximately 500 questionnaire returns. Krejcie and Morgan (1970) informed the recruitment target as a general planning reference. For this non-probability sample, the reference does not establish a population margin of error or power for the indirect association. The bootstrap confidence interval describes the precision of the indirect estimate in the analytic sample.

There were 496 returned questionnaires. Fourteen were excluded before the available item-level file was formed, leaving 482 cases. The available record did not categorise the initial exclusion reasons. A subsequent response-pattern screen excluded respondents who selected the same value across all 72 core questionnaire items. Fifty-seven responses met this rule, leaving 425 students. The screen included literacy, stress, anxiety, and depression items because the wider questionnaire administered all four measures. Only anxiety is analysed as the dependent variable in this article.

Of the invariant responses, 28 selected category three throughout, 12 selected category five, 11 selected category four, and six selected category one. Uniform responding across distinct constructs can indicate insufficient response differentiation, although it does not establish motivation or inattention in every case (Meade & Craig, 2012; Ward & Meade, 2023). The rule was not documented as preregistered. All reported estimates use the retained sample of 425. No missing values were recorded on the core items in the available 482-case file, so score construction required no item imputation.

3.2 Measures

Perceived new media literacy was assessed using 35 items based on Koc and Barut (2016). The questionnaire allocated seven items to functional consumption, 11 to critical consumption, seven to functional prosumption, and 10 to critical prosumption. The analysis used the sum of all items, with a possible range of 35–175. Higher scores indicated greater perceived competence. The broad total was used to examine the overall association rather than separate effects of the intended dimensions.

Digital stress was assessed using 24 items based on Hall et al. (2021), covering availability stress, approval anxiety, fear of missing out, connection overload, and online vigilance. The summed score ranged from 24 to 120, with higher scores indicating greater stress. The five components were represented by one observed total in the proposed indirect association.

Anxiety symptoms were measured using six items selected from the Chinese college-student mental-health framework described by Zheng et al. (2005). Scores ranged from 6 to 30, with higher values indicating greater

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symptom endorsement. The administered questionnaire used a one-to-five agreement format for all core items. No additional reverse scoring was applied because the retained scoring information did not identify reverse-keyed items. The anxiety score was interpreted as a research measure of symptom endorsement.

The questionnaire was administered in Chinese. Literacy and stress items were translated for collection. The supplied analysis examined internal consistency and exploratory factor structure in the formal sample, with no separate pilot dataset. The intended dimensions were not fully recovered, so the observed totals require qualification. Measurement evidence is reported below alongside the association estimates.

3.3 Statistical analysis

Three ordinary least squares equations estimated the association pattern. The stress equation was $M = iM + aX + eM$. The total-association equation was $Y = iT + cX + eT$. The conditional outcome equation was $Y = iY + c'X + bM + eY$. The indirect association was ab. With the same observations and these linear specifications, $c = c' + ab$ apart from rounding. The models used observed sum scores and included no demographic covariates.

Individual regression coefficients were accompanied by HC3 heteroskedasticity-consistent standard errors and two-sided 95% t confidence intervals using residual degrees of freedom (Hayes & Cai, 2007). The indirect interval was obtained from 10,000 respondent-level bootstrap resamples using seed 20261019. Both component paths were re-estimated in each resample, preserving the pairing of each respondent's scores. The 2.5th and 97.5th percentiles formed the indirect confidence interval (Preacher & Hayes, 2008). Analyses were implemented in Python using NumPy and SciPy.

Original-score estimates retain their interpretation in questionnaire units. The fully standardized indirect association was calculated as ab multiplied by the standard deviation of literacy and divided by the standard deviation of anxiety. Standard deviations were recomputed within bootstrap draws. Incremental R^2 compared the literacy-plus-stress equation with literacy alone. Partial R^2 expressed this increment relative to variance remaining after literacy, while f^2 divided the increment by one minus full-model R^2. These quantities describe the fitted association and its magnitude within the retained sample.

3.4 Ethics and consent

Participants were informed about the study purpose, the voluntary nature of participation, and their right to stop answering. Students provided written informed consent by signing a consent form. The questionnaire did not request names, student numbers, or other direct identifiers. Findings are presented in aggregate.

The study did not obtain formal ethics approval.

RESULTS

4.1 Sample characteristics and measurement evidence

The analytic sample comprised 80 men and 345 women. There were 175 first-year, 205 second-year, 37 third-year, and eight fourth-year students. Major groups were Art Theory (n = 71), Music and Dance (n = 28), Drama and Film (n = 69), Fine Arts (n = 129), and Design (n = 128). Annual family income was below RMB 100,000 for 259 students and RMB 100,000–300,000 for 133. The three higher categories contained 16, seven, and 10 students. Women and students in the first two academic years therefore formed most of the sample. Age and daily screen time were unavailable for this participant profile.

Table 1 presents descriptive statistics and internal consistency. Anxiety symptoms averaged 18.40 on the six-item sum score. Alpha coefficients were high for all three measures. Exploratory evidence nevertheless qualified interpretation of the broad literacy and stress totals. Parallel analysis suggested two literacy factors and three stress factors, fewer than the intended four and five dimensions. Forced theoretical solutions explained approximately 75.19% and 74.46% of variance, respectively, with overlap among intended components and particular concern about functional prosumption. These findings leave the structure underlying the totals incompletely resolved.

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Table 1 Descriptive statistics and internal consistency

Measure	Items	Range	Mean	SD	α
Perceived new media literacy	35	35–175	138.46	23.13	.985
Digital stress	24	24–120	80.68	17.50	.966
Anxiety symptoms	6	6–30	18.40	5.44	.944

Note. N = 425. All scores are item sums. Alpha describes internal consistency within this administration.

4.2 Total and component associations

Perceived literacy correlated positively with digital stress (r = .202) and negatively with anxiety symptoms (r = −.143). Stress correlated positively with anxiety symptoms (r = .465). In the literacy-only equation, the total literacy–anxiety coefficient was −0.03355, 95% CI [−0.06153, −0.00558], p = .019. Literacy accounted for 2.03% of anxiety-score variance. This supported H1 as an inverse association within the retained sample. A ten-point difference in literacy corresponded to approximately 0.34 fewer anxiety-score points in this fitted equation.

Literacy was positively associated with digital stress, a = 0.15262, 95% CI [0.06471, 0.24052], p < .001. The standardized coefficient was .202, and the stress equation explained 4.07% of stress-score variance. In the conditional anxiety equation, digital stress had a positive coefficient, b = 0.15995, 95% CI [0.12617, 0.19372], p < .001. The direct literacy coefficient was −0.05796, 95% CI [−0.08075, −0.03518], p < .001. Their standardized coefficients were .514 and −.246, respectively.

Table 2 Regression coefficients and indirect association

Association	Estimate	95% CI	Standardized
Literacy to stress a	0.15262	[0.06471, 0.24052]	.202
Stress to anxiety b	0.15995	[0.12617, 0.19372]	.514
Direct literacy to anxiety c′	−0.05796	[−0.08075, −0.03518]	−.246
Total literacy to anxiety c	−0.03355	[−0.06153, −0.00558]	−.143
Indirect association ab	0.02441	[0.01023, 0.03847]	.104

Note. N = 425. Coefficient intervals use HC3 standard errors. The indirect interval uses 10,000 respondent-level percentile bootstrap resamples. The standardized indirect estimate is rounded here and reported with its interval in Table 3. The b and c′ paths are mutually adjusted.

4.3 Indirect association and magnitude

For RQ1, the indirect estimate was positive, ab = 0.02441, 95% bootstrap CI [0.01023, 0.03847]. Its sign opposed the negative direct coefficient. The decomposition was −0.05796 + 0.02441 = −0.03355. Thus, the positive stress-related component partly offset the inverse direct association, producing a weaker negative total association. The fully standardized indirect estimate was 0.1037, 95% bootstrap CI [0.0426, 0.1662].

Adding digital stress increased R^2 from .0203 to .2741. The reported increment, calculated before rounding the model totals, was .2537, 95% bootstrap CI [.1544, .3639]. Partial R^2 was .2590 and f^2 was .3495. Digital stress therefore contributed substantial additional within-sample fit after literacy. Table 3 reports uncertainty around these magnitude estimates. The variance increments quantify association within the specified equations and do not establish the expected benefit of changing digital stress.

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Table 3 Magnitude estimates and bootstrap uncertainty

Quantity	Estimate	95% bootstrap CI
Fully standardized indirect association	.1037	[.0426, .1662]
Incremental R^2 from digital stress	.2537	[.1544, .3639]
Partial R^2 for digital stress	.2590	[.1582, .3699]
f^2 for digital stress	.3495	[.1879, .5871]

Note. N = 425. Intervals are the reported percentile intervals from 10,000 respondent-level bootstrap resamples.

DISCUSSION

5.1 Perceived competence and digital pressure

The central finding is that perceived new media literacy had opposing components in its association with anxiety symptoms. Students reporting greater literacy tended to report fewer anxiety symptoms overall. At the same time, literacy was positively associated with digital stress, and stress was positively associated with anxiety conditional on literacy. The positive indirect product partly offset the inverse direct association. This pattern makes digital pressure relevant to understanding the literacy–anxiety relationship even when the overall literacy association is favourable.

The positive literacy–stress path deserves particular attention. New media literacy concerns perceived capabilities for consuming, evaluating, producing, and participating (Lin et al., 2013; Koc & Barut, 2016). Digital stress concerns the perceived demands accompanying connection (Steele et al., 2020; Hall et al., 2021). Greater capability may coexist with availability expectations or concern about approval because these demands arise within relationships and communication practices. Barber and Santuzzi's (2017) account of telepressure offers a related explanation for how feeling obliged to respond can persist across contexts.

For art students, digital participation could involve visible presentation of creative work and sensitivity to feedback. Greater perceived competence might accompany more extensive participation, while greater knowledge could make digital pressures easier to recognise. These explanations remain provisional because the questionnaire did not directly measure posting visibility, feedback exposure, communication requirements, or participation intensity. Reverse relationships and shared influences are also possible. Students experiencing stress may acquire skills to manage demands, while anxiety may shape both competence ratings and pressure appraisals.

The size of the first-path association places a further boundary on interpretation. Literacy explained approximately 4% of digital-stress variance. Other conditions therefore account for most observed stress variation. The result supports examining perceived competence alongside demands while leaving the main sources of those demands open to further study.

5.2 Contribution to communication research

The article connects perceived media capabilities with experiences of digitally mediated communication. Studies of media use and anxiety, including Vannucci et al. (2017), examine exposures that differ from literacy. Burke and Kraut (2016) additionally show why communication type and relationships deserve consideration. The present results extend this line of questioning by distinguishing perceived capability from pressure within the same analytical model. An inverse total association can coexist with a positive component associated with digital stress.

The conditional literacy coefficient also requires careful interpretation. Its stronger negative magnitude after stress enters the equation reflects the opposing signs in the decomposition. It describes the literacy–anxiety relationship among students with the same fitted stress score. Because the design provides no temporal ordering

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or intervention, the coefficient does not estimate how much anxiety would change if a student acquired literacy skills while stress was held fixed. The contribution lies in identifying a pattern that a stronger design can test.

5.3 Implications for art education

The findings provide a rationale for evaluating literacy education alongside the communication conditions of creative study. Source evaluation, audience awareness, and production decisions concern students' capabilities. Response expectations, feedback arrangements, and requirements for public presentation concern the conditions in which those capabilities are used. Addressing both could help institutions formulate more specific questions about students' digital experiences.

For example, a portfolio assignment could clarify whether public posting is required, how audience reactions relate to assessment, and when students should expect feedback. A collaborative production could establish communication responsibilities and reasonable response windows. These proposals follow from the distinction between competence and pressure. Their effects on anxiety would need to be evaluated through a prospective study that also examines participation and learning outcomes. The present associations supply a reason to investigate those arrangements. Institutions could also evaluate workshops on media literacy and healthy online habits, and assess whether students can access counselling when they need it.

5.4 Limitations and future research

The cross-sectional design limits interpretation of the proposed indirect pathway. Concurrent mediation estimates may differ from the longitudinal processes of interest (Maxwell & Cole, 2007). Future research could assess perceived and demonstrated literacy before a defined period of digital coursework, then repeatedly measure demands and anxiety. Such a design would improve temporal resolution while still requiring attention to common causes and the distinction between within-student change and between-student differences. A multi-institution study could examine whether the associations recur across settings. Interviews or focus groups could help explain how students experience online feedback, public portfolios, and expectations about responding.

Measurement is a second limitation. All constructs came from one self-report administration, creating scope for common-method influences (Podsakoff et al., 2003). The high alpha values do not resolve the incomplete recovery of the intended literacy and stress dimensions. Further work should examine the item structure, the justification for using broad totals, and the empirical separation of stress content from anxiety symptoms. Performance tasks and records of specific communication demands could help distinguish competence, participation, and appraisal. The analysis provides exploratory structural evidence. A confirmatory analysis with item-level data could assess the adapted factor structures and whether stress and anxiety are distinguishable. Shared response method remains a possible contributor to the observed associations.

The response-pattern screen also limits robustness claims. Fifty-seven of the 482 available responses were excluded because they were invariant across all core items. This rule is reproducible, but uniform responding does not prove inattention in every case. The reasons for the earlier 14 exclusions were unavailable. A comparison of the 482-case and 425-case models is needed to establish how screening affects the positive literacy–stress path and indirect estimate. The reported estimates therefore remain conditional on the screening rule.

Finally, recruitment was non-probability based, the sample was concentrated in women and the first two academic years, and institutional or teaching-group identifiers were unavailable for modelling dependence. The unadjusted equations may also reflect unmeasured differences in academic workload, social support, sleep, or daily screen time. Future analyses should select adjustment variables through an explicit causal rationale and report how conclusions vary across defensible specifications. The present article's focus on anxiety was selected during manuscript development from a questionnaire containing multiple outcomes, so confirmation in an independent sample would strengthen the finding. Differences across art disciplines warrant a separate analysis with adequate representation in each group.

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CONCLUSION

Among 425 retained art undergraduates in Hunan, perceived new media literacy had a modest inverse total association with anxiety symptoms. Digital stress formed a positive indirect component that partly offset the negative direct association. The findings suggest that perceived competence and experienced digital demands belong in the same account of students' digital communication experiences. Their temporal relationship and educational implications require stronger measurement, sensitivity checks, and prospective evaluation.

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