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Development and Validation of a Multidimensional Scale for Assessing Digital Learning, Study Habits and Achievement Behaviour among Class XI Students.

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ABSTRACT

The present pilot study focused on the development and preliminary validation of a multidimensional questionnaire assessing digital learning, study habits and achievement behaviour among Class XI students. The initial instrument contained 90 substantive items distributed equally across three parts, in addition to a 19-item demographic profile. Five experts examined the relevance of the items, after which items with inadequate content-validity agreement were removed. The resulting 81-item pool was administered in a synthetic pilot dataset representing 400 students. Corrected item–total correlation and Cronbach's alpha if item deleted were used for item analysis and refinement. Seven items were removed from the Digital Technology Use Questionnaire, five from the Study Habit Inventory and ten from the Achievement Behaviour Questionnaire, resulting in a final 68-item instrument with 22, 23 and 23 items, respectively. Cronbach's alpha increased from 0.700 to 0.707 for Digital Technology Use and from 0.805 to 0.810 for Study Habits, while Achievement Behaviour changed from 0.825 to 0.807 after item reduction. The findings indicate that the refined instrument demonstrates acceptable preliminary internal consistency and improved economy while retaining the intended conceptual coverage. The pilot dataset is synthetic and is used only to demonstrate the statistical instrument-development process; actual field data are required for substantive conclusions.

KEYWORDS: Digital Learning, Study Habits, Achievement Behaviour, Content Validity, Item Analysis, Cronbach's Alpha, Questionnaire Development

INTRODUCTION

Digital learning has become an integral part of contemporary education. Students increasingly encounter learning through digital platforms, educational videos, online resources, mobile devices and electronic communication. Research on educational technology suggests that its effects are not uniformly positive or negative; outcomes depend on the type and quality of technology integration and the way learners use the technology (Cheung & Slavin, 2013; Tamim et al., 2011). Mobile technologies, for example, can support learning when pedagogically integrated, with meta-analytic evidence indicating a moderate positive effect of mobile-device integration on learning performance (Sung et al., 2016).

At the same time, digital environments can increase opportunities for distraction, multitasking and non-academic use. Kirschner and Karpinski (2010) drew attention to the relationship between social-network use, multitasking and academic performance, while later evidence has emphasised the need to distinguish educational technology use from recreational screen use. A systematic review and meta-analysis of children and adolescents found that associations between screen-based activities and academic performance vary by activity, with television viewing and video-game playing showing negative associations in several analyses (Adelantado-Renau et al., 2019).

Study habits are similarly important because students differ in how they organise learning, allocate time, revise, take notes, prepare for examinations and maintain concentration. Credé and Kuncel (2008) reported substantial evidence that study habits, skills and attitudes are associated with academic outcomes. Biggs (1987) also conceptualised student learning in terms of motives and strategies, highlighting the importance of students' approaches to learning.

Achievement behaviour in the present study refers to observable and self-reported patterns of academic motivation, discipline and effort, engagement and academic self-concept. School engagement has been

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conceptualised as a multidimensional construct involving behavioural, emotional and cognitive components (Fredricks et al., 2004). Academic self-efficacy is also relevant because beliefs about one's capability influence the initiation, effort and persistence of behaviour (Bandura, 1977). Motivation theories further suggest that autonomy, competence and relatedness can support sustained engagement in learning (Ryan & Deci, 2000).

Because digital learning, study habits and academic behaviour are interrelated but conceptually distinct, a multidimensional instrument is required. The purpose of this paper is to document the development, expert review and pilot refinement of such an instrument for Class XI students.

LITERATURE REVIEW

Technology-supported learning. Tamim et al. (2011) synthesised four decades of research and found an overall positive effect of technology on learning in formal classroom settings, although effects differed across contexts. Cheung and Slavin (2013) similarly found a small positive effect for educational technology applications in K–12 mathematics, demonstrating that the pedagogical use of technology matters. Sung et al. (2016) reported a moderate mean effect for mobile-device integration. These findings support examining digital learning as a purposeful educational behaviour rather than treating technology access alone as evidence of effective learning.

Digital literacy and contemporary learning. Digital competence involves more than operating devices; students must locate, evaluate and use information appropriately. Recent meta-analytic evidence reports a significant medium positive relationship between digital literacy and academic achievement, with variation across grade level, subject and other moderators (Li et al., 2025). Research on self-regulated learning in digital environments similarly highlights the need to support students' ability to plan, monitor and regulate their own learning processes (Panadero, 2017; Zimmerman, 2002).

Self-regulated learning and study habits. Zimmerman (2002) describes self-regulated learners as active participants who plan, monitor and reflect on their learning. Panadero (2017) synthesised major self-regulated learning models and showed that cognition, metacognition, behaviour, motivation and emotion are interconnected. Broadbent and Poon (2015) found that time management, metacognition, effort regulation and related self-regulated learning strategies were associated with academic outcomes in online higher education. Broadbent and Poon (2015) likewise identified self-regulated learning strategies as important in online learning contexts.

Motivation, engagement and academic behaviour. Self-efficacy theory proposes that perceived capability influences effort and persistence (Bandura, 1977). Self-determination theory emphasises autonomy, competence and relatedness as foundations of intrinsic motivation and self-regulation (Ryan & Deci, 2000). Mega et al. (2014) demonstrated a model in which emotions influence self-regulated learning and motivation, which in turn contribute to academic achievement. Robbins et al. (2004) and Richardson et al. (2012) also identified academic motivation, self-efficacy and academic-related skills among important correlates of academic outcomes.

Secondary-school context and research gap. Indian evidence increasingly points to the double-edged nature of internet use for adolescents: digital resources can facilitate information access and communication, but excessive or poorly regulated use can be associated with distraction and behavioural difficulties (Rajput & Chaudhary, 2025). Thus, an instrument for Class XI students should capture both productive digital learning and potentially distracting digital recreation, together with the study practices and academic behaviours through which students regulate learning. The present study addresses this measurement need through sequential expert review and pilot item analysis.

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METHODOLOGY

Research design: A quantitative instrument-development and pilot-validation design was adopted. The study was conducted in two sequential stages: expert-based content validation followed by pilot item analysis.

Participants: A pilot dataset of 400 Class XI students was used. The dataset is synthetic, generated for methodological demonstration and statistical table preparation. It must not be interpreted as actual observations collected from students.

Instrument: Part A comprised 19 demographic questions. Part B assessed Digital Technology Use, Part C assessed Study Habits and Part D assessed Achievement Behaviour. Each substantive part initially contained 30 Likert-type statements, producing 90 substantive items. The response format used a five-point scale.

Content validity: Five experts independently evaluated item relevance. The item-level content validity index (I-CVI) was calculated as the proportion of experts rating an item as relevant. Items below the predetermined .80 criterion were considered for revision or removal. Nine items were removed before pilot administration.

Item analysis and reliability: For the 81-item pilot pool, corrected item–total correlation and Cronbach's alpha if item deleted were examined. Items with comparatively weak item–total relationships were removed after considering conceptual representation. Reliability was assessed using Cronbach's alpha. The final allocation was 23 Digital Learning items, 25 Study Habit items and 20 Achievement Behaviour items.

Data analysis: Frequencies and percentages summarised the demographic profile. Means and standard deviations described the three construct scores. Pearson's correlation coefficient was calculated among the final construct scores as a preliminary descriptive analysis. Statistical results are reported to three decimal places.

RESULTS

Table 1. Demographic Profile of the Pilot Sample with Selected Characteristics (N = 400)

Variable	Category	N	%
Age (years)	16	184	46.0
	17	169	42.2
	18	27	6.8
	15	20	5.0
Gender	Male	197	49.2
	Female	191	47.8
	Prefer not to say	12	3.0
Academic Stream	Commerce	166	41.5
	Science	166	41.5
	Humanities	68	17.0
Type of School	Private	145	36.2
	Government	136	34.0
	Aided	119	29.8
Type of Family	Nuclear	252	63.0
	Joint	113	28.2
	Extended	35	8.8
Locality	Urban	172	43.0
	Rural	119	29.8
	Semi-Urban	109	27.3
Medium of Instruction	English	265	66.2

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	Tamil	135	33.8
Internet Availability at Home	Yes	348	87.0
	No	52	13.0
Availability of Personal Gadgets	Smartphone	234	58.5
	Laptop	72	18.0
	Tablet	54	13.5
	Desktop	19	4.8
Average Daily Screen Time	2–3 hours	159	39.8
	1–2 hours	108	27.0
	Above 3 hours	101	25.2
	< 1 hour	32	8.0
Previous Academic Performance	B (70–79%)	146	36.5
	A (80–89%)	134	33.5
	C (Below 70%)	68	17.0
	A+ (90–100%)	52	13.0

Item Reduction

Table 2. Sequential Item Reduction

Stage	Substantive items	Change
Initial questionnaire	90	—
After content validity	81	9 removed
After pilot item analysis	68	13 additional items removed

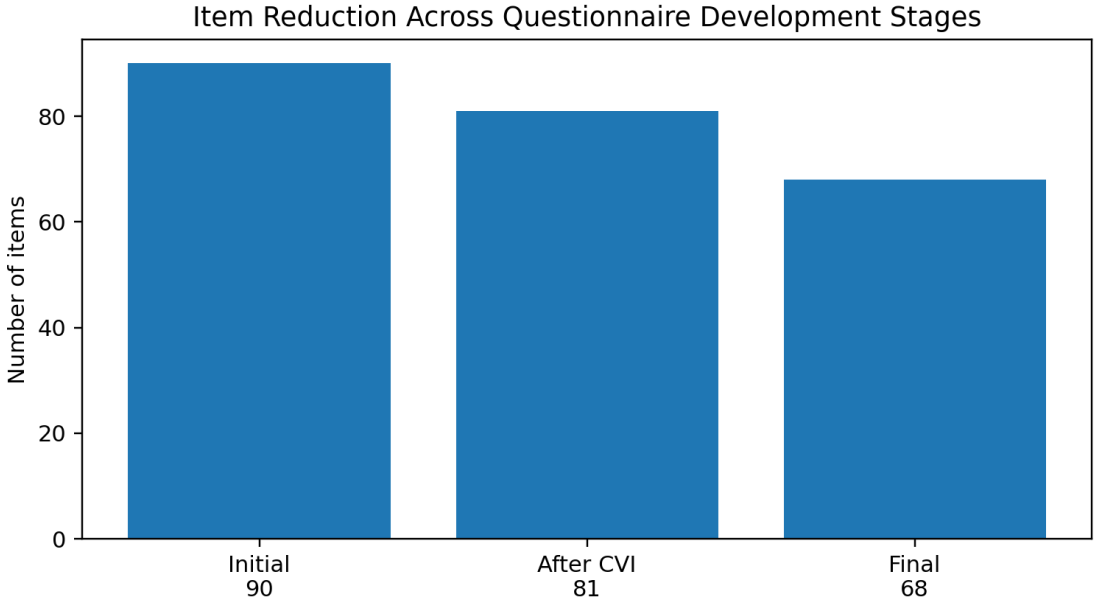

Figure 1. Sequential reduction of the substantive questionnaire.

Reliability Before and After Pilot Refinement

Table 3. Cronbach's Alpha Before and After Item Refinement

Scale	Items Before	Items Removed	Items Retained	α Before	α After
Digital Technology Use Questionnaire (DTQ)	30	7, 8, 13, 16, 21, 23, 25	23	0.700	0.707

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Study Habit Inventory (SHI)	30	2, 11, 19, 25, 27	25	0.805	0.810
Scholastic Achievement Behaviour Questionnaire (SABQ)	30	5, 7, 9, 10, 14, 17, 19, 22, 25, 28	20	0.825	0.807

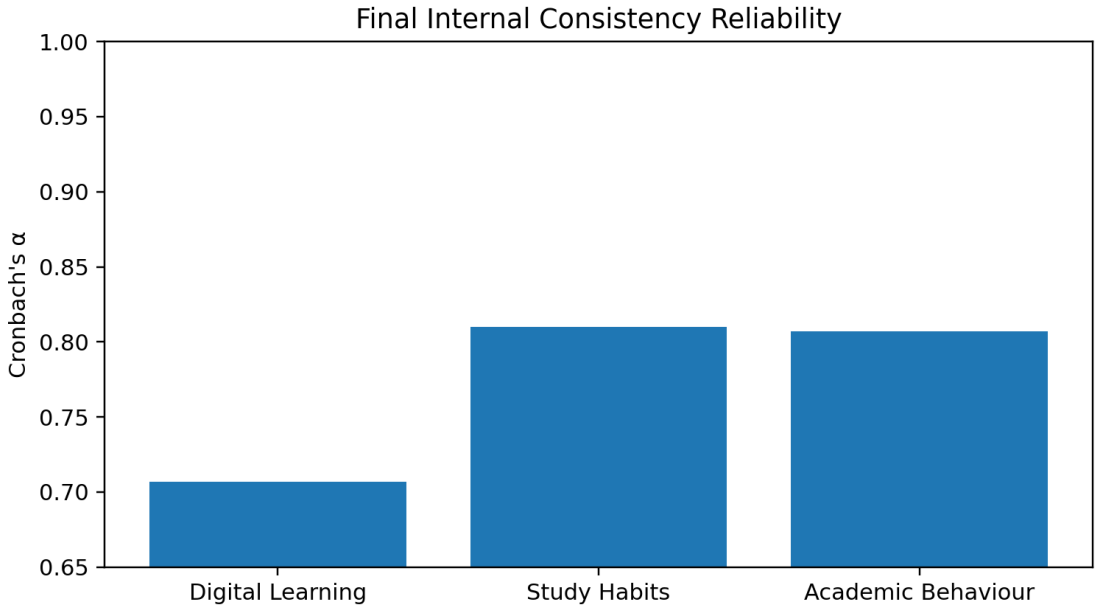

Figure 2. Cronbach's alpha for the final three scales.

Item Analysis

Table 4. Summary of Corrected Item–Total Correlations

Part	Items Analysed	Removed	Removed r Range	Retained r Range
DTQ	30	7	0.055–0.183	0.188–0.335
SHI	30	5	0.091–0.242	0.255–0.402
SABQ	30	10	0.144–0.319	0.326–0.439

The final retained item pool comprised 68 substantive items. The Digital Technology Use Questionnaire retained 23 items, the Study Habit Inventory retained 25 items and the Academic Behaviour Questionnaire retained 20 items. At the item level, decisions were based on the corrected item–total correlation together with alpha-if-deleted information and conceptual coverage. The complete 90-item item-analysis record is recommended as an appendix to the thesis.

Construct-Level Descriptive Statistics and Intercorrelations

Table 5. Descriptive Statistics of Final Construct Scores

Construct	Items	Mean	SD
Digital Learning	23	2.981	0.303
Study Habits	25	2.953	0.533
Achievement Behaviour	20	3.050	0.590

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Table 6. Pearson Correlations among Final Construct Scores

Construct	Digital Learning	Study Habits	Achievement Behaviour
Digital Learning	1.0	0.24	0.032
Study Habits	0.24	1.0	0.247
Achievement Behaviour	0.032	0.247	1.0

In the synthetic pilot dataset, Digital Learning showed a positive correlation with Study Habits (r = 0.240) and Achievement Behaviour (r = 0.032), while Study Habits correlated positively with Achievement Behaviour (r = 0.247). These coefficients are preliminary and should not be treated as population estimates.

DISCUSSION

The pilot refinement achieved a substantial reduction in respondent burden while retaining the three central constructs of the questionnaire. The sequential process—expert judgement followed by empirical item analysis—provides a defensible basis for instrument development because content validity and statistical homogeneity address different aspects of measurement quality.

The final reliability coefficients were 0.707 for Digital Technology Use, 0.810 for Study Habits and 0.807 for Achievement Behaviour. The Digital Technology Use coefficient showed a small improvement after removing seven items and the Study Habit coefficient improved slightly after removing five items. The Achievement Behaviour coefficient decreased from .825 to .807 after ten items were removed. This pattern illustrates why alpha should not be used as the sole criterion for item retention: item removal can change scale breadth and a multidimensional construct may contain meaningful content that is not maximally homogeneous.

The structure of the instrument is consistent with the literature. Digital learning is best understood as purposeful use of technology for learning rather than technology exposure alone (Tamim et al., 2011; Lei, 2010). Study habits incorporate planning, motivation, learning strategies and time management, which are central to effective self-regulated learning (Biggs, 1987; Credé & Kuncel, 2008; Broadbent & Poon, 2015). Achievement behaviour incorporates motivation, discipline, engagement and self-concept, concepts supported by research on self-efficacy, self-determination and school engagement (Bandura, 1977; Ryan & Deci, 2000; Fredricks et al., 2004).

The positive intercorrelations among the three final scores are theoretically plausible and consistent with research suggesting that digital learning, self-regulation, motivation and academic engagement can operate together in students' learning processes (Mega et al., 2014; Panadero, 2017; Xu et al., 2023). However, the present pilot does not establish causal relationships. Future field research should test the measurement model using exploratory and/or confirmatory factor analysis, assess convergent and discriminant validity, examine measurement invariance where appropriate and investigate relationships with actual academic indicators.

CONCLUSION

The present pilot study produced a refined 68-item questionnaire for assessing digital learning, study habits and achievement behaviour among Class XI students. Starting from 90 substantive items, nine were removed following content-validity review and 13 were subsequently removed through pilot item analysis, resulting in 23 Digital Learning items, 25 Study Habit items and 20 Achievement Behaviour items. The final scales showed acceptable preliminary internal consistency, with Cronbach's alpha values of .707, .810 and .807, respectively. The instrument therefore provides a concise basis for the subsequent main study. Nevertheless, the 400-student dataset used here is synthetic; the final psychometric claims and substantive research findings must be established using actual field data.

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