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The Future is Connection:

Collaboration, Creativity and Compassion in a Digital Society

Exploring the use of Generative AI in vocational design education

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Generative AI (GenAI) image tools are increasingly used in vocational design education, yet little is known about how students perceive such tools and how it affected their self-regulated learning (SRL). This study examined how first-year design students in a Singapore Technical and Vocational Education and Training (TVET) institution used GenAI. Using a pre-post survey (*n*= 281) and semi-structured interviews with students (*n*= 30) and instructors (*n*= 7), the survey results showed that metacognitive self-regulation improved the most, followed by critical thinking and completeness, while perceived ease of use declined and accuracy showed no significant change. Content analysis of student interviews revealed that SRL gains were concentrated in reactive adaptation rather than planning or reflection. While instructors faced teaching challenges it is recommended that a GenAI literacy module should precede assessed design work.

Keywords: Generative AI, design education, self-regulated learning, vocational education

Introduction and methods

Technical and Vocational Education and Training (TVET) design programmes are increasingly adopting Generative AI (GenAI) image tools, reducing the time and labour once needed. With the usage of these tools, students may bypass good habits such as planning, monitoring, adapting, and evaluating their learning across cognitive, motivational, and behavioural dimensions (Pintrich, 2004). Students who lack self-regulated learning (SRL) abilities are more likely to accept AI outputs without critical evaluation (Xu et al., 2025), and they tend to use fewer metacognitive strategies (Khaled et al., 2015). In Singapore, students can join vocational education directly from secondary school, admitted on academic results rather than portfolio, and therefore often lack prior design knowledge. Self-regulation and critical evaluation may be especially important for these students in developing sound design judgement. Students' perception of these tools also shapes how they engage and learn (Chan & Hu, 2023). With limited studies in the TVET design contexts, this study examines students' self-reported SRL and perceptions of GenAI tools, alongside students' and instructors' experiences in a Singapore TVET institution. Students from four design courses used GenAI image tools over a 10-week module to develop an illustration based on an assigned art style, submitting at least six prompt iterations and a final hand-drawn piece. The pre-post survey (*n*= 281) comprised five subscales on a five-point Likert scale: metacognitive self-regulation (12 items) and critical thinking (five items) from the MSLQ (Pintrich & De Groot, 1990), and ease of use, completeness, and accuracy (three items each) from Wixom and Todd (2005). Survey data were analysed using descriptive and inferential statistics. Semi-structured interviews with students (*n*= 30) and instructors (*n*= 7) were analysed using content analysis (Mayring, 2014) with a deductive coding scheme based on the survey constructs and additional themes were developed inductively.

Findings and implications

Survey results showed metacognitive self-regulation improved the most, followed by critical thinking and completeness. Ease of use declined significantly while accuracy showed no significant change. Content analysis of student interviews (*n* = 30) resulted in 345 coded meaning units across seven themes. Metacognitive self-regulation was mostly concentrated in the control phase where students were adjusting their strategy to the GenAI outputs. Most adaptations were self-initiated rather than instructor scaffolded. Critical thinking depended on students' prior knowledge of the assigned art style. Those who had done research could identify errors in the visual output, while others required instructor support.

Completeness and accuracy reflected students learning to build more specific prompts over time, although students commented that the AI output regularly ignored specific design instructions. Ease of use was manageable for tool operation, but students found effective prompting hard as they cannot articulate their visual design intent effectively in English. Others ran out of platform credits or lost time switching between tools. Another group of students demonstrated agency over their creative work by using GenAI only to support their own ideas, some suggested to omit the use of GenAI, citing their identity as artists or ethical concerns. Content analysis of instructor interviews (n = 7) yielded 80 coded meaning units across four categories. Instructors faced teaching challenges (n = 26, 32.5%), including misaligned assessment criteria that could not distinguish genuine engagement, compressed timelines, and developing GenAI competence alongside students without institutional support. To scaffold critical thinking (n= 23, 28.7%), instructors used oral consultations to test whether students understood their own work or required students to complete traditional design processes such as mind mapping before using GenAI. Scaffolding tool use (n= 16, 20.0%) included teaching prompt structures, providing keywords, and reverse engineering prompts from reference images. Scaffolding self-regulated learning (n= 15, 18.8%) included milestone check-ins and progressive assignment design. Six of seven instructors recommended that a dedicated GenAI literacy module should precede assessed design work. Future modules should explicitly scaffold planning, monitoring, and reflection through effective shared teaching practices. Design knowledge and GenAI literary should be established before students use GenAI.

Table 1.
A summary of survey findings and student interviews

Subscales/ Themes	Pre		Post		*t*	*p*	Cohen's *d*	Coded units *n* (%)	Example quotations
	M	*SD*	*M*	*SD*	(280)				
Metacognitive self-regulation	3.39	0.45	3.48	0.44	−4.11	<.001	0.25	102 (29.6%)	"I submitted six but did about 40. I kept trying until I found what I liked"
Critical thinking	3.53	0.59	3.63	0.53	−3.22	.001	0.19	80 (23.2%)	"I only realised it did not match the assigned style when my teacher told me"
Ease of use	3.35	0.70	3.21	0.82	3.06	.002	−0.18	31 (9.0%)	"Hard to use specific words that work"
Completeness	3.14	0.75	3.28	0.68	−3.41	<.001	0.20	46 (13.3%)	"I list down keywords in commas"
Accuracy	3.27	0.64	3.34	0.58	−1.95	.053	0.12	48 (13.9%)	"Whatever I imagined it almost never produced exactly'"
Challenges	-	-	-	-	-	-	-	19 (5.5%)	"I burned through four ChatGPT accounts because of the credit limit"
Agency	-	-	-	-	-	-	-	19 (5.5%)	"I'm an artist. I really value human artwork and creativity'"

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