OVERCOMING ACADEMIC ANXIETY AMONG UPPER SECONDARY SCHOOL STUDENTS THROUGH ARTIFICIAL INTELLIGENCE AND VISUALIZATION

Svitlana Lytvynova
Institute for Digitalisation of Education of the NAES of Ukraine, Kyiv, Ukraine
E-mail: s.h.lytvynova@gmail.com

Abstract. This conceptual paper examines how artificial intelligence (AI) and visual narratives might be used to support upper secondary school students who experience anxiety when completing demanding learning tasks. The proposal draws on control-value theory of achievement emotions, cognitive load research, and literature on AI-supported personalisation and human oversight. It distinguishes academic anxiety from anxiety about AI technology and outlines a Storybook-based pedagogical approach combining adaptive explanations, metaphorical visualisations, opportunities for low-stakes practice, and teacher-guided reflection. Seven illustrative anxiety-related situations and corresponding textual and visual prompts are presented. The potential benefits, design constraints, and safeguarding requirements are critically discussed. The proposed mechanisms are theoretically grounded but have not been experimentally tested in this paper; therefore, anxiety reduction is treated as a hypothesis for future empirical investigation, not an established outcome.

Keywords: academic anxiety; upper secondary education; generative artificial intelligence; visual narratives; cognitive load; emotional support; Storybook.

I. INTRODUCTION

Upper secondary school students may experience anxiety when confronted with complex, abstract, or high-stakes learning tasks, particularly in STEM subjects. Such anxiety has to be considered alongside the cognitive demands of a task, students' prior knowledge, and the way in which they perceive their ability to succeed. According to the control-value theory of achievement emotions, students' appraisals of control and the significance of academic outcomes are associated with emotions including anxiety, hope, and enjoyment [8]. Consequently, pedagogical support should address not only the difficulty of the learning material but also the learner's perceived control over the task.

Traditional instructional responses often focus on simplifying explanations. Although this can be useful, it may be insufficient when students also fear errors, public judgement, or failure. Research on multimedia learning and cognitive load suggests that the organisation and coordination of verbal and pictorial information matter for effective processing [4], [6]. This provides a rationale for exploring AI-assisted, carefully designed visual narratives that support understanding without introducing unnecessary information. It does not establish that particular colours, characters, or images have a clinical or therapeutic effect.

The purpose of this paper is to justify and describe a pedagogical design for using generative AI and Storybook-style visual narratives to support students' engagement with anxiety-provoking learning tasks. Specifically, it proposes design principles, illustrates seven possible classroom situations, and identifies hypotheses and safeguards for future empirical testing. The paper is a conceptual and methodological contribution; it does not report a controlled intervention, a student sample, or measured changes in anxiety.

In this paper, anthropomorphic representations refer to the use of characters that assign human-like attributes to non-human figures or abstract concepts. The characters function as narrative devices rather than psychological treatment tools.

Visual metaphors are understood as images that use familiar visual relationships to make less familiar or abstract concepts easier to discuss. A metaphor becomes pedagogically useful only when its elements are explicitly connected to the target concept and do not distort scientific meaning.

Inclusive design is understood here as planning alternative ways to access and understand learning materials while taking account of students' differing needs, abilities, contexts, and preferences. Visual narratives should therefore be optional and accompanied, where necessary, by textual explanations and accessible alternatives.

The proposed instructional mechanism is that adaptive explanation may make a task more manageable, guided metaphorical visualisation may facilitate initial comprehension, and low-stakes opportunities to revise responses may support perceived control. On the basis of control-value theory, these conditions could be relevant to academic anxiety [8]. However, whether a Storybook scenario leads to such changes among adolescents remains an empirical question. This distinction is particularly important when formulating recommendations for the New Ukrainian School and for the safe use of AI in education.

II. REVIEW OF RESEARCH LITERATURE

The available literature provides a theoretical foundation for AI-supported learning but is more limited as direct evidence for reducing academic anxiety in secondary school students. Hwang and Tu [1] reviewed applications of artificial intelligence in mathematics education, including intelligent tutoring, diagnosis of learning difficulties, and adaptive support. Kasneci et al. [2] discuss both the educational opportunities of large language models, such as personalised explanations and feedback, and the need for critical verification, teacher oversight, and appropriate AI literacy. Neither work directly demonstrates that metaphorical AI-generated narratives reduce adolescents' anxiety.

Ouyang and Jiao [3] distinguish AI-directed learning, AI-supported collaboration, and AI-empowered learning in which learners take greater agency. This distinction supports positioning an AI assistant as a scaffold for students' own reasoning rather than as a replacement for decision-making. Hwang and Tu [1] likewise provide evidence that personalisation and tutoring are established areas of AI research in mathematics education. These contributions justify the instructional role proposed here, but they should not be interpreted as experimental proof of its emotional effects.

Academic anxiety and AI anxiety must be distinguished. The former concerns emotions related to learning, performance, and assessment, whereas the latter concerns apprehension about AI technologies themselves. Wang and Wang [5] developed and validated a scale measuring AI anxiety in a general respondent sample; that study did not assess academic anxiety among upper secondary pupils. Its relevance to the present work is to highlight that introducing AI may itself create apprehension and therefore requires clear instructions and alternatives. Pekrun's control-value theory [8] offers the more direct theoretical basis for discussing anxiety related to learning outcomes.

Skulmowski and Xu [4] show that the effects of digital design on cognitive load are complex: some features may increase extraneous processing while also benefiting motivation or learning. Mayer and Moreno [6] explain how appropriately coordinated verbal and pictorial representations can help manage multimedia-related cognitive load. Together, these studies warrant an instructional design in which images clarify the target concept, excess detail is limited, and students are invited to explain the connection between the metaphor and the subject content. They do not justify a universal claim that pastel colours or anthropomorphic illustrations reduce anxiety.

Ethical and practical safeguards are equally important. UNESCO's guidance on generative AI in education and research [7] emphasises human-centred use, age-appropriate safeguards, and protection of personal data. In the present proposal, teachers retain responsibility for content accuracy, instructional suitability, and student well-being. Anxiety-related prompts should not be used to infer mental-health diagnoses, and learners should not be required to disclose sensitive emotional information to an external AI system.

Taken together, the research suggests a conditional explanatory pathway, not a demonstrated therapeutic effect: a well-scaffolded explanation and an accurate visual representation may reduce unnecessary processing demands [4], [6]; opportunities to make choices and correct errors may strengthen perceived control over learning [3], [8]; and increased perceived control may be associated with more adaptive achievement emotions [8]. Each link is theoretically motivated, but the complete pathway has not been experimentally tested for the Storybook scenarios proposed here.

III. MAIN DISCUSSION

The proposed approach treats generative AI as a teacher-supervised instructional support that may help students approach difficult tasks without immediate public evaluation. Its pedagogical logic comprises four linked elements: (1) clarification of a specific learning difficulty; (2) adaptive explanation matched to prior knowledge; (3) a visual narrative that gives the concept an intelligible structure; and (4) low-stakes practice followed by reflection. Through

the lens of control-value theory [8], these elements might increase students' perceived control, which is a plausible pathway to more adaptive academic emotions. The causal pathway is proposed, not measured, in the present paper.

Adaptive rephrasing is one feasible AI function. For example, an assistant can explain integration by parts or genetic recombination using a simpler vocabulary, provide a worked example, and then return to the formal disciplinary terminology. To prevent superficial understanding, the explanation should progress from an accessible representation to the original concept, and the student should complete a comparable task independently. This use of scaffolding is consistent with AI-supported and learner-empowered models [1], [3].

Visual generation provides a second design option. A Storybook-style sequence can portray an abstract relationship through a familiar character or setting, while captions identify the corresponding scientific elements. According to multimedia learning research, the pedagogical value of this approach depends on the accuracy, relevance, and coordination of the representations [4], [6]. Warm pastels or anthropomorphic characters may be selected as an aesthetic preference, but the paper does not claim that they have independently verified anxiety-reducing or therapeutic properties.

Private, formative practice may offer another advantage when students are reluctant to reveal incomplete answers in front of peers. A carefully configured AI assistant can provide repeated explanations and non-punitive feedback, while the teacher checks the feedback and retains responsibility for assessment. Nevertheless, privacy is not automatically guaranteed merely because an interaction occurs with AI. In line with UNESCO guidance [7], students should avoid submitting identifying or sensitive information, and AI-based inference of their emotional states should not be undertaken without an appropriate legal, ethical, and institutional framework. Non-AI alternatives must remain available.

Several limitations follow from the evidence and must be addressed in the instructional design [2], [4], [7]:

- excessive simplification can obscure conceptual complexity; therefore, explanations should lead back to accurate disciplinary language and independent reasoning;
- generative systems may produce incorrect STEM explanations or misleading images; therefore, subject-specific verification by teachers is essential;
- overreliance on AI may diminish opportunities for dialogue with teachers and peers; therefore, Storybook activities should include collaborative explanation and reflection;
- student inputs, generated responses, and any discussion of emotional difficulties require privacy-by-design safeguards; therefore, sensitive disclosures and automated emotional profiling should be avoided.

Accordingly, the intended role of AI is to support, rather than replace, students' own reasoning and teachers' professional judgement. The central outcome to be evaluated is not whether an illustration appears friendly, but whether the proposed sequence helps students understand subject matter, sustain engagement, and feel more capable of approaching a difficult task.

The visual style used in the examples is deliberately gentle, but aesthetics should be treated as a design choice and not as an independently validated intervention. Relevant criteria include curricular accuracy, visual clarity, cultural appropriateness, accessibility, and the amount of task-relevant information represented [4], [6].

Stylisation can be useful when it makes essential conceptual relations more visible. However, removing too much detail could also conceal scientifically important distinctions, so each image should be accompanied by a teacher-checked explanation.

A visual narrative can be structured to move from a difficult or uncertain situation towards a small, achievable learning action. This proposed sequencing may support perceived control over the task [8]. Whether students interpret it as reassuring, motivating, distracting, or inappropriate may vary by age, prior knowledge, and personal preference and requires direct investigation.

An anthropomorphic Teacher-Owl, for instance, may serve as a recurring guide who models self-correction. The pedagogical message is that an error can be examined and corrected rather than treated as evidence of personal inadequacy. Students should nevertheless be able to choose conventional diagrams, text explanations, or other representations if they prefer.

Tables 1 and 2 present seven illustrative anxiety-related situations and corresponding narrative scenarios. The examples are proposed instructional materials rather than intervention results. Storybook is used as a visual-narrative

format; a generative system such as Gemini can help draft plots and image prompts, subject to teacher review and the platform's applicable privacy arrangements.

Table 1. Narrative approach to overcoming academic anxiety among upper secondary school students

№	Type of anxiety	Psychological manifestation	Visualisation (image) intended to address anxiety
1	Public speaking	Social anxiety; fear of losing standing in the class or being publicly judged; the feeling that others notice only one's shortcomings.	Building a sense of success. A teenager in a hoodie confidently addresses the class while holding a lantern representing an idea [on the topic]. Neon light dispels the shadows.
2	The blank page	Paralysis when facing demanding examinations (NMT) and creative tasks.	Building confidence. A student faces a blank digital screen. AI suggests an idea [about the topic]. The student confidently works with the material and quickly records new ideas.
3	Making a mistake	Fear that a single mistake will prevent a successful future.	Building resilience. A teenager corrects complex code on a tablet. AI shows that an error is part of discovery, making the work more engaging.
4	Knowledge overload	Cognitive paralysis caused by excessive subject complexity.	Building understanding. A teenager stands in a fog of formulas and data. A Teacher-Owl offers an AI compass [for the topic]. The fog clears, revealing a coherent and logical path.
5	Social comparison	Anxiety about other students' achievements; the feeling of being "worse than everyone else."	Encouraging self-expression. A teenager discovers a unique path through a neon forest of data. AI illuminates their individual strengths [in exploring the topic].
6	Fear of disappointing others	Pressure to meet parents' expectations regarding academic results.	Fostering calm. A teenager shows their parents their learning journey rather than only a grade. The Teacher-Owl (an anthropomorphic AI character) stands nearby. Shadows dissolve into warm embraces.
7	An uncertain future	Uncertainty about career choice and one's future path in life.	Developing decisiveness. A teenager stands at a crossroads marked by neon signs. AI helps analyse the options. The student chooses their own beam of light.

Table 2. Examples of narratives for addressing academic anxiety among upper secondary school students

No.	Type of anxiety and psychological manifestation	Text prompt for an LLM	Visual prompt for Storybook
1	Public speaking (social anxiety; fear of judgement)	"I have to speak in front of my class. Be my cognitive partner: help me turn my fear into a 'lantern of ideas'. Suggest three opening phrases that will help me start my presentation confidently."	Watercolor illustration, warm pastel colors. A teenager in a hoodie stands confidently on a stage, holding a glowing neon lantern. Soft atmosphere.
2	The blank page (paralysis before the NMT examination or essay writing)	"I need to start an assignment, but I feel stuck. Give me three unexpected associations or metaphors for [topic] to help me overcome blank-page syndrome."	Stylized illustration, soft aesthetic. A student sits before a blank digital screen. A friendly AI light sparks an idea. The screen starts to glow with knowledge symbols.
3	Making a mistake (fear for the future following failure)	"I made a mistake in [task]. Explain why it is an important part of my process of discovery. Speak to me as a wise Teacher-Owl to help me overcome my fear of making mistakes."	Warm pastel tones. A teenager is fixing complex code on a tablet. An anthropomorphic Teacher-Owl points to a "glitch" that turns into a beautiful crystal.
4	Knowledge overload (cognitive paralysis when facing complexity)	"I do not understand [topic]. Break down this concept, adapting the terminology to my level of knowledge. Explain it through the metaphor of a journey."	A teenager lost in a fog made of formulas. An anthropomorphic Teacher-Owl hands over a glowing "AI compass". The fog starts to clear, revealing a logical path.
5	Social comparison (the feeling of being "worse than everyone else")	"I see other people succeeding and feel inferior. Help me analyse my unique journey in studying [topic] and highlight my personal strengths."	Neon forest of data, soft lighting. A teenager finds their own unique glowing trail among many others. The AI light highlights the individual's unique steps.
6	Fear of disappointing others (pressure to meet parents' expectations)	"I am afraid of disappointing my parents with my grade. Help me explain my progress and effort so that the focus shifts from the number to my learning journey."	A teenager showing a map of their learning journey to parents. A protective Teacher-Owl stands nearby. Shadows of pressure melt into warm golden hugs.
7	An uncertain future (uncertainty about career choice)	"I am at a crossroads about choosing a profession. Analyse my interests and help me see	A teenager standing at a crossroad with glowing neon signs. The AI helps filter the

		the possibilities as beams of light leading towards success."	options. The student chooses their own beam of light. Encouraging atmosphere.

The metaphors and soft aesthetics in Tables 1–2 are proposed design features intended to encourage engagement and constructive responses to mistakes; their effectiveness in reducing anxiety has not been empirically established in this paper.

A teacher may integrate selected AI tools, including LLM-based text support and teacher-reviewed image generation, at different lesson stages. For each use, the teacher should identify the learning objective, map the visual metaphor to the subject concept, check generated information, and offer an equivalent non-AI route [2], [6], [7].

Prior-knowledge activation (whole-class work). A teacher introduces an abstract concept, such as integration, and invites students to propose visual analogies with AI assistance. Students then evaluate which features of an analogy correspond to the actual concept and which do not. This activity is designed to make initial exploration less intimidating while retaining the accuracy of disciplinary understanding; an effect on anxiety remains a hypothesis.

Independent work and overcoming "blank-page syndrome" (individual work). When a student struggles to begin a task, an AI assistant can offer two or three starting questions, analogies, or progressively less explicit hints. The student then selects a strategy and produces an answer independently. The aim is to support agency and avoid substituting ready-made AI output for learning [3].

Homework and reflection. Students may create a short Storybook sequence illustrating how their understanding of a topic changed. A metaphor such as an AI compass represents a learning strategy, not an autonomous authority. Reflection includes identifying what the student learned, which errors were corrected, and where the analogy stops being accurate.

Final self-assessment. Students may practise with non-graded questions and inspect feedback before formal assessment. The teacher verifies the questions and model answers, while students decide whether to use AI or a conventional worksheet. Any reduction in anticipatory anxiety should be measured with an age-appropriate validated instrument rather than inferred from students' use of the tool.

Proposed evaluation criteria. For future empirical validation, the primary outcome should be change in academic anxiety related to a defined lesson or assessment context, not AI anxiety in general. Secondary outcomes could include students' perceived control, conceptual test performance, engagement, and perceived cognitive load. Comparison conditions should distinguish the effects of teacher scaffolding from those of AI generation or visual styling, and students should be able to decline AI interaction without penalty. Qualitative feedback would also be necessary to identify which metaphors students find useful or misleading [4], [8].

IV. CONCLUSIONS

This paper proposes a theoretically informed pedagogical framework for supporting upper secondary school students who experience anxiety in demanding learning situations. Control-value theory [8] connects academic emotions to appraisals of control; studies of AI in education [1]–[3] suggest opportunities for adaptive support and learner agency; and research on multimedia learning [4], [6] provides criteria for designing comprehensible visual materials. These sources jointly support the plausibility of the approach, but they do not demonstrate that Storybook narratives reduce academic anxiety.

Within the priorities of the New Ukrainian School, the proposed approach could support digital competence, learner-centred teaching, and inclusive access when implemented with teacher supervision and appropriate safeguards [7]. Its intended pedagogical contributions are:

- to promote informed and critical interaction with generative AI rather than passive acceptance of generated answers;
- to create low-stakes opportunities for learning, self-correction, and reflection that may strengthen students' sense of control over difficult tasks;
- to provide differentiated explanations and optional visual representations while preserving disciplinary accuracy and accessible alternatives.

Implementation requires teachers' digital and pedagogical competence, clear criteria for checking AI outputs, and safeguards against the disclosure or automated profiling of students' emotional information. Educational support must not be presented as a substitute for professional mental-health care [2], [7].

The effectiveness of the proposal remains to be established. Further work should compare the Storybook-based approach with a suitable alternative instructional format among upper secondary students, using baseline and follow-up measures of academic anxiety, perceived control, cognitive load, conceptual understanding, and engagement. Age-appropriate validated scales, transparent reporting of sampling and procedures, and attention to possible unintended effects are necessary. Until such evidence is available, the present contribution should be understood as a design framework and a set of testable pedagogical hypotheses.

REFERENCES

[1] G.-J. Hwang and Y.-F. Tu, “Roles and research trends of artificial intelligence in mathematics education: A bibliometric mapping analysis and systematic review,” Mathematics, vol. 9, no. 6, art. 584, 2021. https://doi.org/10.3390/math9060584.

[2] E. Kasneci et al., “ChatGPT for good? On opportunities and challenges of large language models for education,” Learning and Individual Differences, vol. 103, art. 102274, 2023. https://doi.org/10.1016/j.lindif.2023.102274.

[3] F. Ouyang and P. Jiao, “Artificial intelligence in education: The three paradigms,” Computers and Education: Artificial Intelligence, vol. 2, art. 100020, 2021. https://doi.org/10.1016/j.caeai.2021.100020.

[4] A. Skulmowski and K. M. Xu, “Understanding cognitive load in digital and online learning: A new perspective on extraneous cognitive load,” Educational Psychology Review, vol. 34, pp. 171–196, 2022. https://doi.org/10.1007/s10648-021-09624-7.

[5] Y.-Y. Wang and Y.-S. Wang, “Development and validation of an artificial intelligence anxiety scale: An initial application in predicting motivated learning behavior,” Interactive Learning Environments, vol. 30, no. 4, pp. 619–634, 2022 (published online 2019). https://doi.org/10.1080/10494820.2019.1674887.

[6] R. E. Mayer and R. Moreno, “Nine ways to reduce cognitive load in multimedia learning,” Educational Psychologist, vol. 38, no. 1, pp. 43–52, 2003. https://doi.org/10.1207/S15326985EP3801_6.

[7] F. Miao and W. Holmes, Guidance for Generative AI in Education and Research. Paris: UNESCO, 2023. https://doi.org/10.54675/EWZM9535.

[8] R. Pekrun, “The control-value theory of achievement emotions: Assumptions, corollaries, and implications for educational research and practice,” Educational Psychology Review, vol. 18, pp. 315–341, 2006. https://doi.org/10.1007/s10648-006-9029-9.