



Growth mindset in the context of rapid technological change: Psychological mechanisms of fear of mistakes and principles of pedagogical support

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■ **Abstract.** The accelerating pace of technological change and the continual renewal of professional practices increase the demand for specialists who can learn rapidly, reskill, and operate under uncertainty. In this context, a growth mindset was viewed as a core cognitive and motivational frame that supports engagement with complex tasks, readiness for iterative improvement, and a constructive approach to mistakes, in contrast to a fixed mindset that foregrounds "innate ability" and increases the risk of avoidance behaviours. The aim of this article was to provide a theoretical and conceptual rationale for the relevance of a growth mindset in conditions of technological change, to analyse the psychological mechanisms underlying fear of mistakes, and to formulate principles of pedagogical support for fostering growth mindset in higher education. The study combined a narrative review, a targeted literature search across academic databases, interpretive synthesis of selected sources, and analysis of generalised authorial observations from teaching practice. The findings showed that fear of mistakes may suppress participation, initiative, and engagement with complex tasks because error was often

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experienced as socially exposing and personally costly. The study demonstrated that growth mindset cannot be sustained by verbal explanation alone and requires an educational environment that lowers the subjective cost of being wrong. A set of pedagogical principles for supporting a growth mindset was proposed, including normalising mistakes as part of learning, providing process-focused feedback, fostering psychologically safe interactions, systematically reinforcing key growth mindset ideas, and scaffolding self-regulation through staged completion of complex tasks. The article's practical contribution lay in the feasibility of integrating these principles across disciplines and formats, including project-based learning, to strengthen students' readiness to learn in conditions of continuous change

■ **Keywords:** implicit theories of ability; social-evaluative threat; loss avoidance; academic avoidance; self-regulated learning; error-tolerant learning environment; higher education

■ Introduction

Rapid technological change is transforming not only the instruments of professional activity but also the conditions under which specialists learn. New digital tools, AI-based systems, automated routines, and changing workflows make professional competence less dependent on stable bodies of knowledge and more dependent on the capacity to adapt, relearn, and act under uncertainty. In such circumstances, mistakes become an inevitable part of entering new domains, testing unfamiliar solutions, and refining incomplete attempts. Higher education must therefore prepare students not only to demonstrate knowledge, but also to remain intellectually active when certainty is absent and interim failure is unavoidable.

Recent research shows that this challenge is systemic. OECD (2023) argued that education should support not only the acquisition of skills, but also the attitudes and dispositions that enable their development and effective use. The World Economic Forum (2023) likewise showed that technological and socio-economic shifts are changing labour-market demands. Together, these reports strengthen the educational importance of adaptability, reskilling, and learning capacity. Within this context, growth mindset becomes relevant as a framework for explaining how students interpret challenge, effort, and temporary failure. In contemporary educational research, growth mindset is understood as the belief that abilities can be developed through learning, effort, and effective strategies; mistakes, setbacks, and critical feedback are therefore treated not as evidence of deficiency but as opportunities for analysis, adjustment, and development. By contrast, fixed mindset refers to the belief that abilities are largely predetermined and not substantially changeable through education, practice, or support. These beliefs influence whether students approach difficulty as a developmental task or as a situation likely to expose limited ability. At the same time, recent studies do not uncritically adopt this framework. J.L. Burnette *et al.* (2023), in a systematic review and meta-analysis, showed that the effects of growth mindset interventions vary across contexts and depend on implementation fidelity and learner characteristics. This indicates that the educational value of growth mindset cannot

be assumed in advance. B.N. Macnamara & A.P. Burgoyne (2023), examining the same field from a more critical perspective, concluded that many reported effects of such interventions on academic achievement become weak or non-significant when greater weight is given to the most methodologically rigorous studies. Their analysis redirects attention to the conditions under which growth-oriented beliefs can become behaviourally effective.

K. Zhang & W.-J. He (2025) demonstrated that teachers' growth mindset and perceived school climate positively moderate the relationship between students' growth mindset and academic achievement. Their study shows that mindset does not function as an isolated internal belief. Its effects depend on whether the educational environment supports persistence, revision, and engagement with difficulty. Another line of research clarifies why a challenge may become threatening. C.J. Pigart *et al.* (2024), studying fear of negative evaluation in large-enrollment college science courses, showed that this fear is closely linked to academic social comparison and to students' sense of belonging and fit within their field of study. Their findings show that the significance of mistakes in higher education is not purely cognitive. It is also social, since an error may be experienced as a threat to one's image of competence, status, or sense of belonging.

Ukrainian researchers have also addressed related aspects of this problem. V.H. Kremen *et al.* (2023), analysing higher education in Ukraine under wartime and post-war conditions, emphasised that the system faces profound instability and requires new responses to educational transformation. Although their work is not focused specifically on growth mindset, it supports the broader argument that adaptability in higher education has become a practical necessity. L. Petrenko & O. Zelikovska (2025) argued that higher education should develop meta-skills related to rapid learning, self-development, and adaptation to change, and directly connected this task with growth mindset and lifelong learning. S. Sokolovska (2025), examining first-year non-philological students, showed that fear of mistakes functions as a psychological barrier that reduces classroom activity and complicates competence development.

Taken together, these studies show that adaptability is becoming important under technological change, that growth mindset remains educationally relevant but context-sensitive, and that students' responses to difficulty are shaped by the social and evaluative organisation of learning. However, the literature remains fragmented. Some studies focus on macro-level educational transformation, others on the mixed effects of mindset interventions, and still others on fear of negative evaluation or supportive teaching practices. Much less attention has been paid to an integrated pedagogical explanation of how fear of mistakes connects these strands in higher education, namely, how technological uncertainty, beliefs about ability, and evaluative features of the educational environment shape students' readiness to engage with challenge or avoid it.

Thus, the purpose of this study was to examine how fear of mistakes shapes students' readiness to engage with complex tasks under conditions of technological change, to explain this role through the interaction of key psychological mechanisms, and to formulate and substantiate principles of pedagogical support aimed at fostering a growth mindset in higher education and lowering the subjective cost of mistakes.

■ Materials and Methods

This study had a theoretical and conceptual design and was conducted as a narrative review and interpretive synthesis of scholarly literature in educational psychology, higher education research, motivation and stress psychology, and studies of cognitive mechanisms relevant to learning behaviour. In addition, the study included a descriptive analysis of generalised authorial observations, incorporating simple frequency summaries and descriptive comparisons of recurrent fear-related and avoidance-oriented patterns. The purpose of this study was to integrate heterogeneous theoretical and empirical findings into a coherent explanatory framework clarifying the psychological mechanisms underlying fear of mistakes in learning and, on this basis, to formulate principles of pedagogical support aimed at fostering a growth mindset in higher education under conditions of rapid technological change. The study was not designed as a systematic review in the strict methodological sense and did not aim to provide exhaustive coverage of all publications on the topic. Rather, it focused on conceptually significant sources that were directly relevant to the article's research problem.

The literature search included peer-reviewed journal articles, review papers, meta-analyses, monographs, book chapters, and analytical reports addressing growth mindset, fixed mindset, fear of mistakes, fear of failure, social-evaluative threat, negative experiences of error, loss aversion, feedback, avoidance behaviour, and related pedagogical conditions. Sources were identified through Google Scholar, Education Resources Information Center, PsycINFO, Scopus, and Web of

Science using combinations of English and Ukrainian keywords corresponding to these constructs. In addition, the reference lists and citation trails of key publications were examined in order to identify foundational primary sources and conceptually relevant studies. Priority was given to recent publications, especially those from the last five to ten years, while earlier works were retained only when they were necessary for defining the core conceptual framework of the field.

Among the candidate mechanisms considered in the review, particular attention was given to loss avoidance, drawing on the broader literature on loss aversion, because the present study addressed situations in which participation in learning involved not only potential educational gains but also socially meaningful losses, such as loss of status, confidence, or perceived competence. This mechanism was retained as analytically relevant because it offered a direct explanation for why students may avoid difficult tasks, safer subtasks, or public participation when mistakes are experienced as socially costly. Its selection was also supported by recurrent authorial observations of risk minimisation and postponement of uncertain integrative stages of project work.

The analytical procedure combined interpretive synthesis of the selected literature with descriptive analysis of recurrent observational patterns. The selected literature was examined to clarify how growth mindset and fixed mindset are conceptualised in educational research and how these constructs are linked to students' responses to challenge, effort, feedback, and temporary failure. Studies from psychology and behavioural research were then analysed to identify mechanisms that may explain why mistakes are often experienced not simply as cognitive errors, but as emotionally and socially threatening events. Particular attention was paid to findings related to social evaluation, the disproportionately strong impact of negative experiences of error, and loss avoidance. Publications on teaching practices, classroom climate, feedback, and student participation were also considered in order to identify features of the educational environment that either intensify or reduce fear of mistakes. On this basis, a conceptual framework was constructed and used to formulate pedagogical principles relevant to higher education.

The literature synthesis was complemented by generalised authorial observations drawn from the shared teaching practice of all five authors between 2018 and 2025. These observations covered 196 first-, second-, and third-year students enrolled in the Applied Mathematics degree programme. They were accumulated across lectures, practical classes, and project-based learning, including teamwork, interim project work, and final project defence situations. Because the authors taught different disciplines within the same educational programme, the observations made it possible to compare recurring behavioural patterns across different instructional formats and subject areas rather than within

a single course only. The observations were conducted in accordance with the Code of Ethics of Academic Relations and Integrity of the National Technical University “Kharkiv Polytechnic Institute” and with the Ethical Guidelines for Educational Research of the British Educational Research Association (National Technical University “Kharkiv Polytechnic Institute”, 2023; British Educational Research Association, 2024). These norms emphasise respect for participants, academic integrity, confidentiality, and the minimisation of potential harm in educational research. In the present study, the observational material was used only in generalised form and without disclosure of identifying personal data. The study was conducted in accordance with international ethical requirements for conducting research involving human subjects. All respondents participated voluntarily and had previously given their informed consent to take part in the study. During the collection and analysis of empirical data, the anonymity of participants and the confidentiality of the information obtained were ensured. The study was conducted in accordance with the principles of respect for human dignity, beneficence, and the protection of the rights and well-being of participants (World Medical Association, 2013).

These observations were not collected as a formal qualitative dataset with standardised coding after every class. Instead, each author kept individual reflective notes on salient and recurrent episodes, especially those involving silence after an incorrect public answer, visible fear of saying something wrong before peers or instructors, avoidance of difficult tasks, procrastination in situations of uncertainty, preference for safer subtasks during project work, and difficulties with the timely integration of separately completed project components. The observations were subsequently discussed collectively by the authors across semesters, especially after project defences, when recurrent patterns of student behaviour became particularly visible. In this way, the observational material was not treated as isolated anecdotal evidence, but as repeatedly compared and generalised pedagogical experience accumulated over several years. In the present study, these authorial observations did not function as an independent empirical dataset and were not used to derive statistical estimates or formal qualitative categories. Their role was illustrative and interpretive. They were used

to compare the conceptual patterns identified in the literature with stable patterns repeatedly encountered in actual teaching practice. In particular, they helped to confirm the pedagogical relevance of several recurring tendencies, such as students’ reluctance to answer after an initial incorrect response in front of others, their preference for safer subtasks when given a choice, the postponement of complex integrative stages of project work until deadlines, and the heightened difficulty of combining individually completed parts into a coherent interdisciplinary project product. Thus, the observations supported the plausibility of the theoretical synthesis but did not replace it.

The study’s methodological limitations stemmed from this design. Since the review is narrative and interpretive, source selection was necessarily selective rather than exhaustive. In addition, the authorial observations, although extensive and accumulated over several years, were based on reflective pedagogical notes and collective professional discussion rather than on a formally standardised empirical protocol. For this reason, they should be regarded as contextualised illustrative material that strengthens the pedagogical grounding of the proposed framework, but not as standalone evidence for causal claims. Their main value lies in showing that the mechanisms discussed in the literature are consistent with stable patterns repeatedly observed in higher education practice and in indicating directions for further research using more formalised qualitative and quantitative designs.

■ Results

To clarify how fear of mistakes relates to mindset in higher education, growth and fixed mindsets were analysed along dimensions particularly salient to students’ academic experience. In contemporary research, growth mindset is not reduced to the simplistic message “try harder”; rather, it concerns the perceived developmental potential of abilities and the meaning assigned to difficulty, effort, mistakes, and feedback. This made it possible to identify paired contrasts that show more precisely how the two orientations differ in the student learning context, especially with regard to learning goals, response to challenge, the role of effort, attitudes to mistakes and feedback, and the significance of social comparison. These contrasts were summarised in Table 1.

Table 1. Typical features of growth mindset and fixed mindset (paired contrasts)

Aspect	Growth mindset: typical beliefs and responses	Fixed mindset: typical beliefs and responses
Nature of abilities	Abilities can develop (within realistic constraints); improvement relative to one’s own starting point is emphasised	Abilities are largely fixed; outcomes reflect “how much one is naturally given”
Learning goals	Preference for mastery goals; focus on progress and competence development	Preference for performance goals; focus on demonstrating and confirming ability
Response to challenge	Difficulty is seen as a normal part of learning; willingness to try strategies and seek help	Difficulty is perceived as a threat to self-worth and as “evidence” the task is “not for me”; tendency to avoid
Explaining failure	Failure provides information for strategy adjustment; increased effort combined with new approaches	Failure signals low ability; tendency toward helpless attributions

Table 1. Continued

Aspect	Growth mindset: typical beliefs and responses	Fixed mindset: typical beliefs and responses
Role of effort	Effort is a tool for development, but effectiveness depends on strategy quality and support	Effort may be interpreted as a sign of low ability ("if I have to try this hard, I must not be capable")
Attitude to mistakes and feedback	Mistakes are learning resources; critique is treated as data for improvement (in a supportive environment)	Mistakes are threats; critique is perceived as an evaluation of personal qualities, reinforcing avoidance
Strategic approach to learning	Search for alternative strategies, reflection, and readiness to change one's approach	Strategy rigidity; rapid reduction of effort after early signs of difficulty or failure
Social comparison	Social comparison is less decisive; one's own trajectory and learning process matter more	Social comparison becomes a key criterion of "capable vs not capable"
Explaining others' success	Others' success can inform strategy, modelling, and inspiration	Others' success intensifies self-worth threat, leading to envy or distancing

Note: the table summarises typical patterns described in the literature. In real educational settings, mindsets may be mixed, and their manifestations depend on context (group norms, teaching style, and assessment practices)

Source: developed by the authors based on C.S. Dweck (2006), C.S. Dweck & D.S. Yeager (2019)

Table 1 shows that the contrast between growth mindset and fixed mindset is expressed not in abstract declarations alone, but in how learners interpret challenge, effort, mistakes, feedback, and social comparison. In growth-oriented patterns, difficulty is more likely to stimulate reflection, strategy adjustment, and further engagement. In fixed-mindset patterns, the same difficulty is more readily experienced as a threat to competence and social image. In higher education, this distinction is especially important because it shapes whether students approach academic difficulty as a developmental opportunity or avoid it as a potentially exposing situation. This contrast becomes especially important in situations where students make mistakes. In such situations, fear of making mistakes can be interpreted as a multi-component phenomenon emerging at the intersection of social-evaluative threat, the disproportionately strong impact of negative experiences of error, and loss avoidance. Taken together, these mechanisms helped explain why avoidance-oriented learning behaviour may be misread as passivity, weak motivation, or insufficient ability, even though its immediate function is often self-protection against social and reputational risk. Social-evaluative threat changes the status of a mistake from a purely cognitive event to a socially exposed event. Under conditions of public response, peer comparison, or visible instructor judgment, an incorrect answer may be experienced not simply as an unsuccessful attempt, but as a sign of incompetence before others (Somerville, 2013; Downing *et al.*, 2020). In such situations, answering orally, proposing a hypothesis, asking a question, or defending an interim result may be perceived as a high-risk act. This mechanism is especially important in youth, when peer evaluation, status, and belonging remain psychologically salient.

Negative experiences of public error may carry a disproportionately strong weight in later participation. Shame, harsh criticism, or ridicule are often remembered and emotionally encoded more strongly than multiple neutral or supportive experiences (Baumeister *et*

al., 2001; Rozin & Royzman, 2001; Brown *et al.*, 2024). As a result, even a single negative episode may reshape expectations about future participation and increase the likelihood of avoidance. This also means that an objectively safer learning environment may still be interpreted as threatening if prior negative experience has not been counterbalanced by repeated situations in which mistakes are treated constructively. Loss avoidance affects the moment of decision about whether to participate, attempt, or remain silent. In a pedagogical context, a perceived "loss" may involve not only a grade, but also time, reputation, confidence, or social status. If learning interaction is structured so that a mistake is experienced as a sanctioned "loss of face", then participating in discussion, asking a question, or publicly attempting to solve a problem becomes psychologically costly (Kahneman & Tversky, 1979; Downing *et al.*, 2020). From this perspective, minimising participation may appear rational as a form of self-protection.

This framework is especially relevant under conditions of technological change, which increase the frequency of situations characterised by novelty, uncertainty, and partial incorrectness. Mastering new tools, methods, and practices predictably involves trial, hypothesis generation, revision, and inevitable errors. If the educational environment continues to function primarily as a public test of "ability," the gap widens between the declared need to "learn how to learn" and the actual tendency to avoid situations in which such learning must occur. Within this model, academic procrastination may be interpreted as one possible manifestation of avoidance. Postponing a complex task delays the immediate testing of competence and temporarily reduces exposure to potentially negative evaluation, although procrastination itself remains a multifactorial phenomenon and cannot be reduced to mindset alone. To make the recurrent patterns identified in the authorial observations more explicit, the observational material was additionally summarised through simple descriptive indicators. Table 2 presents the frequency of the main fear-related and avoidance-oriented patterns

documented among the observed students before project-based learning and after repeated project-based learning. This comparison was intended to show not

only the initial prevalence of these patterns, but also their descriptive change after students had accumulated sustained project experience under pedagogical support.

Table 2. *Frequency and descriptive change of fear-related and avoidance-oriented patterns before and after repeated project-based learning among 196 unique students*

Observed pattern	Before project-based learning: number of students	Before project-based learning: percentage of the total sample	After repeated project-based learning: number of students	After repeated project-based learning: percentage of the total sample	Change in percentage points
Reduced further participation after an incorrect public answer	129	65.8	72	36.7	-29.1
Explicit fear of negative evaluation in reflection	73	37.2	61	31.1	-6.1
Preference for safer subtasks in project work	143	73.0	118	60.2	-12.8
Postponement of integrative project stages until the deadline	117	59.7	80	40.8	-18.9
Difficulty integrating individually completed components into a coherent product	103	52.6	95	48.5	-4.1

Source: developed by the authors

In Table 2 “Before project-based learning” refers to observations made prior to students’ first project experience, whereas “after repeated project-based learning” refers to observations made after two completed projects, at the stage of the third project. The table reports the number and share of unique students for whom each pattern was documented at least once in the authors’ reflective notes. Because one student could contribute to more than one category, the percentages do not sum to 100. The broader instructional context included 9 academic course groups and 91 project teams observed between 2018 and 2025. As shown in Table 2, several fear-related and avoidance-oriented patterns were widespread before project-based learning, especially the preference for safer subtasks and reduced further participation after an incorrect public answer. At the same time, comparing the period after repeated project-based learning with the period before indicates that these patterns did not remain equally pronounced. The most substantial decrease concerned reduced participation after an incorrect public answer, while postponement of integrative stages until the deadline also declined noticeably. Preference for safer subtasks remained relatively frequent, yet became less pronounced after repeated project experience. By contrast, explicit fear of negative evaluation and difficulty integrating individually completed components changed only modestly. These descriptive dynamics suggest that repeated project-based learning, combined with sustained pedagogical support, may reduce some manifestations of fear of mistakes and avoidance, especially those related to public participation and delay of uncertain tasks. At the same time, the more limited change in other categories indicates that such support should not be interpreted as a universal or immediate solution.

The generalised authorial observations were broadly consistent with this explanatory model. Across lectures and practical classes, it was repeatedly observed that after an initial incorrect public answer some students became markedly less willing to participate further in the discussion. In subsequent reflection, this withdrawal was often associated with fear of appearing incompetent before both instructors and peers. In project-based learning, students and teams tended to prefer safer and more predictable subtasks when such choice was available, while more uncertain and integrative components were avoided or postponed. A further recurrent pattern concerned the delayed integration of individually completed project components into a coherent interdisciplinary product. Although separate parts were often completed earlier, teams repeatedly postponed the most complex integrative stage until the deadline approached, which suggested avoidance of the phase most strongly associated with uncertainty and the possibility of visible failure. These patterns do not constitute independent empirical proof, but they strengthen the pedagogical plausibility of the proposed model by showing its consistency with stable features of real instructional practice.

The analysed material also indicates that fixed mindset should be interpreted not only as an individual belief, but also as a mode that may be reproduced by recurring environmental signals. When assessment and communication are organised around a rigid “right or wrong” scheme with immediate public sanction, learners may develop learned caution: participation is perceived as a risk to one’s social image, and a mistake is experienced as a reputational rather than an educational cost. Under such conditions, even explicit growth-oriented messages do not translate easily into behaviour

because the environment itself reinforces avoidance as an adaptive strategy. This helps explain why approaches reduced to motivational slogans often have limited effects. A particularly influential type of contextual signal involves stereotypical labels about “natural” suitability for subject domains, for example, distinctions between “humanities-oriented” and “technical” types or self-descriptions such as “I’m not a math person.” Such labels simplify explanations of success and failure but simultaneously strengthen fixed interpretations of ability. Difficulty and early mistakes are then read as evidence that something is “not my domain,” which fuels withdrawal from further attempts. Research on mathematics identity shows that students’ perceptions of themselves as a “math person” are linked to motivation and achievement (Radišić *et al.*, 2024). Other studies show that preservice teachers do not always recognise fixed-ability beliefs in students’ statements and may lack ready-to-use pedagogical responses to them (Rieche *et al.*, 2019). In higher education, instructors’ own fixed beliefs about ability are likewise associated with less motivating learning experiences and with larger achievement gaps in demanding courses (Canning *et al.*, 2019). The reduction of fixed mindset is therefore relevant not only at the level of learners’ beliefs, but also at the level of pedagogical communication and classroom norms. If educational reality rewards error-free performance and penalises attempts, learners are more likely to prefer silence, adopt minimally risky strategies, and avoid difficult tasks.

These results also make it possible to formulate principles of pedagogical support for fostering a growth mindset in higher education. Their common logic consists in reducing the subjective cost of mistakes while increasing their value as learning information. Assessment design plays a key role here. When only final correctness is rewarded, mistakes retain the status of costly failure. When assessment also recognises iterations, reasoning, hypothesis testing, reflection, and strategy adjustment, the reputational price of being wrong decreases and participation becomes more psychologically acceptable. The social risk of participation likewise requires deliberate reduction. Students are more willing to speak, test ideas, and offer tentative answers when the learning process includes intermediate low-risk stages before public exposure. Brief individual note-taking, short pair or small-group discussion, and anonymous collection of preliminary assumptions or typical errors can provide such a “safe attempt” and help shift participation away from immediate public self-exposure (Fraile *et al.*, 2024).

The framing of questions and tasks is equally important. Questions such as “Who knows the correct answer?” are more likely to activate social-evaluative threat. By contrast, formulations such as “What assumptions are plausible?”, “What data would be needed to test this?”, “What strategy might work?”, or “Where

is the weakest point in the reasoning?” shift attention from the person to the task. This makes partiality, incompleteness, and revision more legitimate and reduces the likelihood that a mistake will be interpreted as evidence of personal deficiency. A productive learning environment also depends on how partially correct answers and feedback are handled. When partial correctness, an error in one step, or an inaccurate assumption is treated as diagnostically useful material rather than as grounds for stigmatisation, the disproportionately strong impact of previous negative experiences can be softened. Supportive feedback is especially important in this respect (Soncini *et al.*, 2022). Feedback that specifies what has already been done well, what requires correction, and what alternative steps are available helps preserve a sense of control and keeps critique within the logic of development rather than personal deficiency. Long-term and complex tasks require special attention, especially in project-based learning. Avoidance often appears not at the stage of routine execution but at the stage of integration, uncertainty, and visible incompleteness. Large tasks therefore benefit from staged planning, short interim outcomes, clear progress criteria, and regular feedback points. These measures reduce the likelihood that the most difficult phase of the task will be postponed until the deadline as a form of self-protective procrastination.

Because fear of mistakes is strongly shaped by anticipated peer response, safe participation also depends on explicit norms of group interaction. Respect for questions, rejection of ridicule, recognition of alternative hypotheses, and clear separation between critique of ideas and evaluation of persons must be reinforced consistently rather than declared once. Without such norms, even well-designed pedagogical interventions remain fragile. Pedagogical support for fostering a growth mindset also requires alignment between declared values and actual procedures. If mistakes are verbally presented as learning resources but assessment and classroom interaction continue to penalise attempts, learners quickly detect the contradiction and return to avoidance strategies. Growth-oriented communication therefore has to be maintained through repeated micro-messages that normalise uncertainty, revision, the temporary absence of correct answers, and the legitimacy of trying again. In high-complexity learning environments, including project-based learning, this consistency may be strengthened through the role of a trainer or coach who helps students interpret critique, presentations, and interim setbacks within a developmental rather than punitive frame. Taken together, these results showed that fear of mistakes in higher education could not be reduced either to individual student beliefs or to isolated motivational messages. It emerges from the interaction between beliefs about ability, the social meaning of mistakes, and the evaluative structure

of the educational environment. Pedagogical support for fostering a growth mindset, therefore, had to be understood not as a single intervention, but as a consistent redesign of how difficulty, participation, feedback, and error were organised in learning.

■ Discussion

The results of this study suggest that fear of mistakes in higher education should not be treated as a secondary emotional response or merely as a minor issue of classroom confidence, since it directly shapes students' willingness either to engage with challenge or to avoid it. Rather, it appears to be a central mechanism through which students' beliefs about ability, the social meaning of evaluation, and the organisation of the learning environment are translated into either engagement or avoidance. In this sense, the interpretation developed in this article was consistent both with recent research showing that the educational significance of growth mindset is strongly context-dependent and with the broader conceptual tradition established in the foundational work of C.S. Dweck (2006) and C.S. Dweck & D.S. Yeager (2019). These earlier studies framed mindset in terms of beliefs about the malleability of ability and linked such beliefs to responses to challenge, effort, and failure. The current study did not revise this conceptual core; rather, it extended it by placing greater emphasis on the social and evaluative conditions under which these beliefs become behaviourally consequential in higher education.

In this respect, the present results are broadly aligned with J.L. Burnette *et al.* (2023), who showed that growth mindset interventions produce heterogeneous effects across contexts and student groups. Their conclusions are important because they caution against treating growth mindset as a universally effective intervention. The results obtained in the present study support this caution. They likewise suggest that the educational relevance of growth mindset depends less on verbal endorsement alone than on whether the learning environment reduces the subjective cost of challenge, error, and revision. At the same time, the present study differs from researchers' in its analytical focus. Whereas their work evaluates intervention outcomes across empirical studies, the present article addresses a conceptual question that remains less explicit in such syntheses, namely, why students may continue to avoid challenge even when growth-oriented values are formally communicated. The proposed answer is that fear of mistakes acts as an intermediary mechanism linking mindset-related beliefs to behaviour under conditions of uncertainty.

B.N. Macnamara & A.P. Burgoyne (2023) took a more critical view and argued that the positive effects of growth mindset interventions may seem more convincing when all available studies are considered together, whereas this conclusion becomes much less

certain when the evidence is judged primarily on the basis of the most methodologically rigorous studies. The present results do not contradict this critique. On the contrary, they help explain why such variability may emerge. If classroom communication, peer response, and assessment practices continue to code mistakes as socially costly events, then interventions aimed only at changing students' beliefs are unlikely to yield stable behavioural change. In this sense, the current study shares the scepticism of the authors toward simplified applications of mindset theory, but it does not treat this as grounds for abandoning the construct. Instead, it argues that the weak or inconsistent effects found in some studies may partly reflect insufficient attention to the emotional and evaluative conditions under which developmental beliefs must operate.

The importance of context in the present results is also supported by K. Zhang & W.-J. He (2025), who found that teachers' growth mindset and perceived school climate positively moderate the relationship between students' growth mindset and academic achievement. Their findings are especially close to the present interpretation because they shift the discussion away from isolated student beliefs and toward the broader ecology of learning. The current results extend this logic by specifying one mechanism through which such ecology operates. It is not only that climate matters in general terms. More specifically, the educational environment matters because it shapes whether mistakes are experienced as manageable stages of learning or as events of public exposure. In this respect, the present study offers a more explicit psychological account of why climate matters. The role of social exposure is strongly supported by C.J. Pigart *et al.* (2024), who showed that fear of negative evaluation in college science courses is closely connected with academic social comparison and students' sense of belonging within their field of study. The present results are consistent with this line of work. They likewise indicate that the significance of mistakes in higher education is not purely cognitive. It is also social, because being wrong may threaten a student's image of competence in the eyes of instructors and peers. At the same time, the present study places this insight within a broader explanatory framework. It suggests that fear of mistakes is strengthened not only by the possibility of being judged, but also by the fact that negative experiences of public error may influence later behaviour more strongly than routine classroom episodes, while participation itself may be avoided if it is associated with a possible loss of status, confidence, or perceived competence.

A similar point applies to the relation between the present findings and the work of V.R. Downing *et al.* (2020). Their study demonstrated that fear of negative evaluation is associated with anxiety in active-learning science courses, which is highly relevant to the present argument. The current results support

this interpretation but also suggest that anxiety alone does not fully capture the pedagogical problem. Avoidance may occur even when students are not visibly anxious, because silence, delay, and risk minimisation can function as strategic forms of self-protection. This distinction is important for higher education practice. If teachers interpret non-participation only as low motivation or weak preparation, they may overlook its defensive function and inadvertently intensify the very mechanisms they wish to overcome. The present results also resonate with L.H. Somerville (2013) work on heightened sensitivity to social evaluation in adolescence and early youth. This developmental perspective helps explain why public mistakes in higher education may acquire disproportionate emotional significance. The current study is consistent with this argument, but it also suggests that developmental sensitivity does not by itself determine behaviour. Its educational consequences depend on whether the institutional setting amplifies or softens this sensitivity. In other words, age-related vulnerability may be a background condition, but classroom norms and assessment practices decide whether it becomes educationally disabling.

The study's interpretation of fixed mindset as a mode sustained by environmental signals rather than as a purely internal belief is also supported by work on identity and pedagogical expectations. J. Radišić *et al.* (2024) showed that mathematical identity, including seeing oneself as a "math person," is associated with motivation and achievement. E.A. Canning *et al.* (2019), in turn, demonstrated that instructors' beliefs in fixed ability are associated with lower student motivation and larger achievement gaps in demanding courses. The present results are close to both studies in showing that beliefs about ability are socially mediated and institutionally reinforced. The difference lies in emphasis. Rather than focusing primarily on identity or teacher beliefs as separate variables, the current study brings them together within a common explanatory frame: when difficulty and mistakes are repeatedly interpreted through labels of natural suitability or insufficiency, fixed-mindset responses become easier to reproduce. This means that reducing fear of mistakes is important because otherwise students may gradually internalise the idea that they are not capable of succeeding in a given academic field.

The pedagogical implications of the present results are also comparable, in part, to the arguments of S. Sokolovska (2025) and L. Petrenko & O. Zelikovska (2025). First author showed that fear of mistakes can function as a direct psychological barrier to student participation and competence development, while the second work linked higher education to the development of meta-skills associated with adaptation, self-development, and lifelong learning. The current study supports both perspectives. It agrees that fear of

mistakes is pedagogically consequential and that adaptability must be treated as a central educational outcome. At the same time, it differs from these works by making the mechanism of connection more explicit. The argument here is that adaptability cannot be developed fully where mistakes continue to carry a high social and evaluative price. Thus, the cultivation of meta-skills and the reduction of fear of mistakes should not be treated as separate pedagogical tasks.

At the same time, the present interpretation invites discussion rather than closing it. One possible objection is that fear of mistakes may be overemphasised relative to other factors affecting student behaviour, such as workload, prior knowledge, general anxiety, self-regulation, or institutional pressure. This objection is valid. The current study does not claim that fear of mistakes explains all forms of passivity, procrastination, or low engagement. Nor does it claim that all fixed-mindset behaviour is reducible to defensive avoidance. Rather, its argument is narrower and more precise: in contemporary higher education, especially under conditions of technological change and complex project work, fear of mistakes is a neglected but powerful mediator that helps explain why students may retreat from the very forms of activity that adaptive learning requires. Another important issue concerns the scope of pedagogical intervention. The results suggest that supportive communication, assessment redesign, and safer participation formats are necessary. Yet this raises a legitimate question: how far can higher education reduce the cost of mistakes without weakening standards, rigour, or accountability? The present study does not advocate eliminating difficulty or evaluation. Its position is different. Rigour is not undermined when mistakes are treated as part of the path toward mastery rather than as evidence of personal inadequacy. What should be reduced is not the cognitive demand of learning, but the unnecessary social penalty attached to visible incompleteness, revision, and interim failure. This distinction is crucial and deserves further empirical debate.

Overall, the present discussion suggests that the main contribution of the study lies in integrating several strands that are often examined separately: mindset theory, fear of negative evaluation, cognitive asymmetries in processing negative experience, and pedagogical conditions for adaptive learning. The resulting framework does not replace empirical intervention research, but it does offer a clearer account of why growth mindset may remain behaviourally weak in environments where mistakes are still experienced as socially risky events. It also helps explain why pedagogical support must extend beyond motivational discourse to the redesign of participation, feedback, assessment, and the broader organisation of teaching and learning. Taken together, these considerations indicate that the problem is not whether students should simply be encouraged to believe in development, but

how higher education can be organised so that developmental engagement becomes psychologically and socially sustainable.

■ Conclusions

This article showed that, in higher education, fear of mistakes constitutes a central barrier to students' readiness to engage with challenge, uncertainty, and complex learning tasks. Within this context, growth mindset was conceptualised not simply as a positive belief in development, but as a framework that changes the meaning of difficulty, effort, feedback, and error in the learning process. The study also demonstrated that students' willingness to participate, persist, and revise their approach depends not only on individual beliefs, but also on whether the educational environment lowers the social and psychological cost of being wrong and treats mistakes as a normal part of mastery rather than as evidence of inadequacy. This barrier can be explained through the interaction of several mechanisms, including social-evaluative threat, the strong impact of negative experiences of error, and loss avoidance. In educational practice, these mechanisms may produce avoidance behaviours such as silence, reduced initiative, and the postponement of complex tasks. When mistakes retain punitive, reputational, or socially exposing meaning, such patterns may stabilise and reduce students' readiness to engage with complex, long-term, and open-ended forms of learning.

The study has also shown that growth mindset cannot be fostered effectively through verbal explanation alone. What proves decisive are the stable rules of the educational environment: how questions are posed, how feedback is given, how partial answers are treated, how assessment is organised, and how instructors communicate expectations about ability, effort, and error. In this respect, particular importance belongs to

the language, success criteria, and interaction norms transmitted by instructors, especially where widespread labels about "natural" suitability for subject domains may reinforce fixed interpretations of ability and narrow students' learning trajectories. A central contribution of the study is the formulation of pedagogical principles that support the development of a growth mindset in higher education by reducing the fear of mistakes and reframing errors as opportunities for learning, reflection, and further development. These principles are united by a common pedagogical logic: reducing the punitive meaning of mistakes, redirecting attention toward thinking and strategy rather than final correctness alone, treating partial answers as a learning resource, supporting self-regulation in long-term tasks, establishing explicit norms for safe discussion, and maintaining consistency between declared values and actual educational practices. Taken together, these principles point to a broader shift in educational culture in which learning depends on the willingness to try, revise one's approach, and continue despite difficulty and temporary failure. A promising direction for further research is the systematic empirical examination of how these principles operate in long-term high-complexity formats, including project-based learning. This would make it possible to clarify the contribution of particular support elements and to determine the conditions under which their effects are most durable.

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Настанова на розвиток (growth mindset) у світі швидких змін: страх помилки та принципи педагогічної підтримки

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■ **Анотація.** Прискорення технологічних змін і регулярне оновлення професійних практик посилили запит на здатність фахівця швидко вчитися, перенавчатися та працювати з невизначеністю. У цих умовах настанова на розвиток (growth mindset) розглядалася як ключова пізнавально-мотиваційна рамка, що підтримує залученість у складні завдання, готовність до ітеративного вдосконалення та конструктивне ставлення до помилок, на відміну від fixed mindset, що фокусує увагу на «природних здібностях» і підвищує ризик поведінки уникання. Мета статті полягала у теоретико-концептуальному обґрунтуванні актуальності growth mindset в умовах технологічних змін, аналізі психологічних механізмів страху помилки та формулюванні принципів педагогічної підтримки розвитку growth mindset, релевантних насамперед для закладів вищої освіти. Дослідження поєднало наративний огляд, цільовий пошук літератури в академічних базах даних, інтерпретативний синтез відібраних джерел та аналіз узагальнених авторських спостережень із викладацької практики. Було показано, що страх помилки та негативного оцінювання міг блокувати участь у взаємодії й ініціативу навіть за наявності навчальної мотивації; його підсилювали непропорційно сильний вплив негативного досвіду помилки, уникання втрат і висока чутливість до соціального оцінювання у підлітковому та ранньому студентському віці. Було запропоновано комплекс принципів педагогічної підтримки growth mindset: нормалізація помилки як частини навчання, процесно-орієнтований зворотний зв'язок, психологічна безпека взаємодії, систематичне коротке підкріплення ключових ідей growth mindset, а також навчання саморегуляції і поетапному виконанню складних завдань. Практична значущість полягала у можливості інтегрувати ці принципи в різні дисципліни та формати, зокрема у проєктно-орієнтоване навчання, для підвищення готовності студентів до навчання в умовах постійних змін

■ **Ключові слова:** уявлення про змінюваність здібностей; соціально-оцінювальна загроза; уникання втрат; академічне уникання; саморегульоване навчання; помилкотолерантне освітнє середовище; вища освіта