

A FRAMEWORK FOR FORMATIVE FEEDBACK, ENCOURAGING ENGAGEMENT AND AUTONOMY OF NEURODIVERGENT STUDENTS

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ABSTRACT

Engineering education requires students to engage with formative feedback that regularly critiques their work. Some neurodivergent students can find this particularly challenging due to Rejection Sensitivity Dysphoria (RSD), an emotionally or physically painful response that can seriously impact their engagement with, and capacity to respond to, perceived criticism. This paper proposes an accessible framework for lecturers that focuses on RSD as a critical yet under-recognised factor shaping students' responses to formative feedback in higher education. Grounded in andragogical principles, the framework encourages tutors to reflect on how language, tone, structure, and intent may be interpreted by adult students whose prior experiences, identities, and emotional responses shape their engagement with feedback. By examining closely one aspect of the neurodivergent experience of perceived judgement, while supporting autonomy, dialogue, and self-directed improvement, the framework seeks to mitigate feedback practices that may unintentionally provoke avoidance or disengagement. Although developed in response to the experiences of neurodivergent engineering students, the framework has wider relevance, offering a structured approach to formative feedback that supports inclusive, reflective, and emotionally responsive practice across Higher Education.

Keywords: Andragogy, neurodivergence, neuro-identities, formative feedback, rejection sensitivity, engineering education

1 INTRODUCTION

It is estimated that the UK has 1.2 million autistic people and 2.2 million people with attention deficit hyperactivity disorder (ADHD) [1]. With a current UK population of 69.8 million, this suggests that around 5% of the population may be neurodivergent, and this is likely to be an underestimation given the growing number of adults seeking assessment and support [2]. There is also a clear need for improved national data, particularly for ADHD assessments, for which no national dataset is currently published [2].

Higher Education Statistics Agency data indicate that approximately 387,000 students were enrolled in UK higher education in 2024/25, of whom around 41,000 were studying Engineering and Technology programmes [3]. Using a conservative 5% estimate, more than 2,000 engineering and related STEM students each year may identify as neurodivergent.

However, increasing numbers of neurodivergent students are only part of the challenge. Research continues to highlight the difference in academics involved in research and those with an education focus [4], that there is a persistent resistance to teaching [5], and there is a perception of teaching as “second tier” academic work [6]. This difference raises concerns that high-quality teaching practice may not be prioritised by some academics and, therefore, the quality or style of formative feedback provided may not be informed by evidence-based teaching practices or pedagogical or andragogical understanding.

2 WHAT IS FORMATIVE FEEDBACK?

Shute [7] provides a detailed review of research on formative feedback, defining it as “information communicated to the learner that is intended to modify his or her thinking or behaviour for the purpose of improving learning.” Shute also highlights a critical qualifier “if delivered correctly” [7]. While the review recognises extensive evidence supporting the importance of feedback in learning, it also reports

that feedback can be ineffective or even harmful. Shute identifies two key features of formative feedback described by Kulhavy and Stock [8]: verification and elaboration. Verification involves confirming whether a learner's response is correct or incorrect. Elaboration provides further detail, such as discussing an error, offering a worked example, or giving what Shute [7] terms "gentle guidance."

2.1 Theoretical base

Narciss and Huth [9] demonstrated that systematically designed formative feedback can positively influence both achievement and motivation. They argue that adapting the content, function, and presentation of feedback, accounting for instructional goals and learner characteristics, can maximise its informative value. Narciss and Huth also propose that feedback frameworks should clearly distinguish between the function, content, form, and mode of presentation of the feedback. They note, consistent with Kulhavy and Stock [8], that these facets are often conflated in existing feedback systems.

2.2 Pre-university models

Pre-university pedagogy, including secondary schools, sixth forms, and further education (FE) colleges, can be characterised as increasingly evidence-based, with a strong emphasis on formative assessment and feedback. These principles align closely with the Assessment for Learning practices outlined in the Department for Education 'Assessment for Learning Strategy' [10].

In secondary education, formative assessment is positioned as a tool for identifying learning gaps, enabling teachers to adjust instruction and supporting students' progress toward summative assessment. Guidance from the Education Endowment Foundation (EEF) is available to teachers [11], who are also required to undertake regular CPD; this is not the case in HE where CPD uptake can be quite variable. National (UK) policy developments further support AfL implementation. The Department for Education *Curriculum and Assessment Review* [12] emphasises assessment, particularly formative assessment, as central to maintaining high standards, tackling inequity, and aligning education with current societal and technological demands across pre-16 and 16–19 pathways. Sixth forms, often part of established school structures, generally retain these principles, adapting them to prepare older learners for advanced examinations and transitions to higher education or employment.

In FE colleges, pedagogy is more diverse due to vocational, technical, and academic programme demands. Recent FE-specific research highlights the complexity of feedback processes, noting that formative assessment is often inconsistently applied and sometimes conflated with summative, accountability-driven practices [13]. Feedback must also account for diverse learner backgrounds, including socio-economic factors, and respond to students' prior experiences and dispositions toward learning. The FE sector is supported by practice guides such as the *2025 Powerful Pedagogy* report [14], which identifies metacognitive approaches, dialogic questioning, and adaptive feedback as key to improving progress and achievement, aligning with EEF-supported principles across the sector.

Overall, secondary, sixth form, and FE settings demonstrate increasing coordination in pedagogical approaches, with formative feedback positioned as a central element of instructional design. In contrast, higher education feedback commonly assumes learner resilience, emotional neutrality, and self-regulation, assumptions that may not hold true for all adult learners and are particularly problematic in the presence of RSD.

3 FEEDBACK IN ENGINEERING

3.1 Academic expectations

Engineering sits at the intersection of science, mathematics, and design, with design further complicated by its need for the understanding of sociological, psychological and physiological aspects of human factors [15]. Studying across these domains is demanding, and studying engineering often exposes gaps in a student's knowledge, understanding, skills, or practice.

Research by Holloway *et al.*, [16], and Baillie *et al.*, [17] highlights the challenge of threshold concepts as defined by Meyer and Land [18]. In engineering, these concepts can act as barriers, leaving students feeling stuck. Holloway *et al.*, also note that crossing a threshold may provoke an emotional response, an "aha" moment, while for others remaining stuck can trigger emotional discomfort [19].

Formative feedback is therefore critical in engineering education, supporting conceptual understanding, design reasoning, and the development of professional competencies, particularly in environments where complex problem-solving and iterative design are central. Emotional responses appear to influence how students experience this process.

Kinnunen's pilot study on students' emotional reactions to feedback reinforces this point. It was observed that "strong negative emotions" were experienced by engineering students and recalled by teachers from their own studies of engineering. The study recommended three strategies to reduce negative emotional reactions: clear learning outcomes, progressive formative feedback on smaller sub-tasks, and promoting student self-assessment [20]. These approaches could be associated with good andragogical practice [21].

While feedback can motivate students, it may also provoke anxiety or confusion when delivered poorly. Lui and Andrade [22] suggest that such responses can hinder learning and discourage risk-taking, which are essential elements of experimentation and engineering design.

Structured frameworks, such as the formative assessment strategies proposed by Wiliam and Leahy [23], have helped standardise and improve feedback practice. These strategies include clarifying learning intentions, designing tasks that elicit evidence of learning, providing forward-looking feedback, and encouraging self-assessment; mirroring those suggested by Kinnunen [20] and Knowles [21].

Overall, formative feedback is a powerful driver for learning in engineering education, but its impact depends on thoughtful, evidence-based implementation. When responsive to student needs, it strengthens understanding, supports skill development, and fosters reflective practice. When applied superficially or without sensitivity to the learner experience, it can fail to achieve its transformative potential and create emotional distance and disengagement.

3.2 Engineering student characteristics

Professor Beverly Gibbs [24], writing for the Engineering Professors Council, asks whether there are more neurodivergent students in engineering than in other subjects, and concludes that we don't know. She notes, however, that higher-education students are not a direct reflection of the general population, and neurodivergent students may represent up to 15% of the student body. This suggests that 12,000 to 15,000 neurodivergent students could be entering engineering courses in the UK each year. The Institution of Engineering and Technology (IET) similarly acknowledges that, while exact numbers are unknown, they possibly underestimate the true prevalence of neurodivergence in engineering [25].

Ortega and Choudry [26] prefer the term "neurological identities" rather than "disabilities," presenting examples of individuals who bypass diagnostic framing and are instead developing an identity, and even a culture, around their neurodivergence. Gibbs [24] also notes that some experience these differences as disabilities and some do not and, even if a student does not consider their neurodivergence a disability, the easiest way to get adjustments or support is often to pursue a process that treats them as if they have a disability.

Separating identity from the discussion still leaves the complex issue of RSD. Cundill [27] notes that while RSD is frequently associated with Autism and ADHD, citing Bedrossian [28], rejection sensitivity may shape the experiences of a much wider range of students in higher and adult educational settings.

4 FORMULATING A FRAMEWORK FOR FORMATIVE FEEDBACK (RSD)

Modestino et. Al., [29] describe RSD as intense emotional responses to perceived criticism. These emotional responses may be disproportionate to the feedback intent but can be decisive in shaping subsequent engagement. Whilst RSD is commonly discussed in relation to ADHD, this emotional dysregulation may be experienced by any student as a response to feedback, and therefore students where other life experiences and contexts may impact on their studies should be considered. For example, a student who has recently been bereaved may be less able to process feedback that is framed for the idealised, resilient student. Recent qualitative and quantitative research shows that feedback may be experienced as both emotionally and physically distressing, leading learners to mask difficulties or disengage from assessment altogether.

The proposed framework (Table 1) considers feedback as a cyclic process, for both students and academics. It is common practice in secondary schools and sixth forms to review marking on a regular basis, to inform best practice and continuing professional development (CPD), and to standardise grading across the faculty. Wiliam and Leahy [23] explored the development of teacher learning communities to provide peer review and accountability. The framework therefore includes Monitoring and Reviewing, with a recommendation to ensure monitoring is established and valued, with structured and consistent approaches that include consideration of knowledge and understanding of RSD.

Table 1. Feedback framework

	Seeing the Dimensions While each element of this framework reflects established good practice, their combination is intentionally oriented toward reducing perceived rejection, emotional threat, and withdrawal behaviours associated with Rejection Sensitivity Dysphoria
	Framing and Intent. Where feedback can be pre-framed as formative and forward-looking, rather than summative, this can signal the developmental intent of the feedback. Offering feedback that is too authoritative or final may amplify perceived judgement. Over-confident language (“clearly incorrect”, “fails to meet”) risks triggering RSD responses [7, 30].
	Language and Tone. Encourage tutors and lecturers to audit feedback language systematically for emotionally charged terms and prioritise task-focused, non-personalised wording. Care is needed to avoid sounding too impersonal or absolute as this may increase emotional distancing.
	Structure and Predictability. Closely aligning feedback to criteria, exemplars, and learning outcomes, in a patterned structure can reduce ambiguity and support engagement with all the dimensions considered. Predictable structures provide cognitive scaffolding and reduce emotional uncertainty.
	Emotional and Cognitive Load. Chunking feedback, prioritising key actions, and separating “must fix” from “optional enhancement” supports effective learning, particularly if delivered in a timely fashion. Excessive detail or exhaustive error identification can be cognitively and emotionally overwhelming for students [7, 20,].
	Agency and Dialogue. Learning questions and reflective prompts, or feed-forward options rather than conclusions can be more encouraging and invite a response, potentially opening dialogue. One-way feedback risks passive receipt rather than dialogue and students may feel reluctant to seek clarification [21].
	Monitoring and Reviewing. A practice of monitoring and reviewing feedback should be established, not only by the individual to inform their future practice, but within and across faculties to inform future assessment, and complete the cycle across all dimensions of feedback.

5 DISCUSSIONS ON IMPLEMENTATION

For some tutors and lecturers this framework perhaps already reflects their own good practice, with steps that seem common sense, such that they may even question the need for such a framework. This means that many students are already receiving high-quality, impactful formative feedback, from tutors and lecturers willing to reflect and fine tune their own approach. However, it is also likely that some academics will consider such a framework unnecessary, particularly where existing feedback practices are perceived as adequate or have become entrenched as part of their normal way of working, or where teaching is considered a secondary aspect of their role and not as important as research. This means that there would also be many students suffering from poorly structured, ineffective feedback, which in some cases may be emotionally and physically distressing.

6 CONCLUSIONS

Rejection sensitivity dysphoria is not unique to neurodiversity or those of differing neuro-identities, but it is debilitating when and wherever it is experienced. The practices around neurodivergence in post-compulsory education at higher education institutions lag behind those in schools, colleges, and further education institutions. A key limitation within the higher education sector for changing formative feedback practice is the understood freedom that academics have operated under for many years with

regards to their own ‘style’ of feedback. Without guidance or a framework, they often develop a style that may be personal, and that they may feel has been adequate or even successful, and therefore difficult to relinquish.

A formative feedback framework developed using an andragogical approach, carefully considering the language used and the emotional impact it can have, and providing a clearer understanding of the importance of addressing threshold concepts, offers the potential for a better, more consistent, and less emotionally challenging student experience, not only for those with specific neuro-identities but for all students of Engineering. This paper offers a theoretically grounded, RSD-informed framework and suggests there is scope for future scholarship in formative feedback that explicitly foregrounds emotional risk, learner agency, and the mediating role of language in undergraduate engineering education.

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