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When Making Is a Choice: Institutional Framing and Emotional Experience Across Learning Environments

Uchechukwu Ekwueme-Duru

Wrexham University, UK

<https://orcid.org/0009-0007-7165-8132>

ABSTRACT

Making is shaped by the institutional conditions in which it occurs, including expectations about competence, the visibility of mistakes, and opportunities to work through uncertainty. This paper explores how these conditions may shape learners' emotional experiences of making across two contexts: a formal technical drawing classroom in Abuja, Nigeria, and an informal design and technology workshop in Dubai, United Arab Emirates. Using interpretive practitioner inquiry, it examines two illustrative episodes from the author's teaching practice, focusing on learners' responses to error, difficulty, and revision. Informed by Self Determination Theory and constructionism, the paper develops a conceptual argument about how institutional framing may shape making as performance, exploration, or a combination of both.

Keywords: Affective conditions of making; emotional engagement; formal and informal learning environments; maker education; self-determination theory; STEM and design education

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INTRODUCTION

The technical drawing studio was on the first floor of the school building, a quiet room that felt different from the others. When students settled in, you could hear the soft drag of pencils on cartridge paper, the occasional click of a set square against a tee-square, and the low hum of conversations. Fifteen SSS2 students worked at adjustable drawing tables, their instruments laid out with the kind of careful neatness that often appears a few weeks before an end of term practical. I was their teacher. Technical drawing, as an elective in most Nigerian schools, usually attracts only a small group of students. These were students who had chosen to be there.

But choosing to be there, however, did not remove the sense of risk.

Manu was one of the strongest students in the class. His work was consistently precise, and he handled drawing instruments with a level of control that set him apart from his peers. He also paid attention to being seen. He would often finish early and look up or call my attention, making sure his progress was noticed. During a lesson on orthographic projection, however, something shifted. After working through an example together, I gave the class a problem to complete on their own. Manu's front and end views were accurate, but his top view contained a small mistake. The hidden detail lines that showed where a cylinder passed through the object were in the wrong position.

When I came over to his desk, he was no longer working. He stared at the drawing, then glanced around the room before his eyes met mine. His posture changed almost immediately. Without saying anything, he turned the paper face down.

The mistake itself was minor and easy to fix. What stood out was his response. In that moment, the possibility that the error might be seen seemed to matter more than fixing it. A student who had spent the term making sure he was visible suddenly chose to withdraw.

I pulled up a chair beside him, turned the paper back over, and asked him to trace the path of the cylinder through the object with his finger. As he followed the form, he paused halfway through and found the mistake on his own. He corrected it and finished the task. The whole exchange lasted only a few minutes, the act of turning the paper stayed with me. It felt like a small but important moment.

This paper begins from moments like that, moments I encountered in my own teaching practice. It examines how the emotional experience of making is shaped by the kind of environment a student is in, especially how visible they feel, how they expect to be judged, and how safe it feels to work through uncertainty, even in a subject they chose to study.

A very different scene from an informal learning space helps bring this into focus. The design and technology workshop where I also worked as an

instructor in Dubai operates outside the structure of a typical school. The space is open, busy, and filled with materials and tools. Workbenches hold projects left in progress, tools line the walls, and the sound of machines blends with the steady activity of children working. The children who come there are enrolled by their parents, but they return because they want to.

In this space, a boy named Nuhu was working on a project he had chosen for himself, building a maze for his hamster. On this day, things were not going well. His cuts were uneven and the structure would not sit properly. Unlike Manu, he continued working. I watched him from across the room as he turned the pieces over in his hands, studying where things had gone wrong. He sketched a new idea in the corner of his worksheet and tried again. When the pieces finally fit together, he lifted the structure, turned it slowly, and smiled. It was a quiet smile, directed at the object in his hands.

The difference between these two moments lies in how each learning environment frames the meaning of making and what feels at stake for the learner. Through its routines, expectations, and forms of evaluation, each setting shapes how learners understand mistakes, competence, and participation. In the classroom, making is closely connected to evaluation. Even when grades are not explicitly discussed, the possibility of assessment may influence how students approach their work. Mistakes can carry emotional weight, and learners may become attentive to how their performance appears to others. In the workshop, making is organized around a project the child has chosen to pursue. Mistakes provide opportunities to reconsider an approach, revise a design, and continue working towards a personally meaningful outcome.

These contrasting episodes raise questions about how the institutional framing of learning environments shapes learners' emotional experiences of making. This distinction is important because making often involves uncertainty, unsuccessful attempts, and repeated revision. How learners respond to these experiences may depend partly on the meanings attached to difficulty and competence in the settings where they work.

The purpose of this paper is to explore how institutional framing shapes the emotional experience of making across formal and informal learning environments. Drawing on two reflective teaching episodes from a secondary school technical drawing classroom in Abuja, Nigeria, and a design and technology workshop in Dubai, the paper examines how learners respond to visible mistakes and difficulty, and how the conditions of each setting may influence their engagement, persistence, and willingness to work through uncertainty. The analysis uses concepts from maker education, academic emotions, and Self-Determination Theory to interpret these experiences.

Research Question

How does institutional framing shape learners' emotional experiences of making, particularly their responses to mistakes, uncertainty, and visible difficulty, across formal and informal learning environments?

The paper contributes to discussions in STEM and design education by directing attention to the affective conditions under which making takes place. It develops the argument that learners' experiences of making are shaped partly by the institutional expectations surrounding participation, competence, and error. Examining these conditions can help educators consider how learning environments may support learners in remaining engaged when technical and creative work becomes challenging.

LITERATURE REVIEW

The Maker Movement in Education

Making as a mode of learning has deep roots in constructionist educational theory (Ioannou & Gravel, 2024), which holds that children learn most powerfully when they build things that are shareable and meaningful to them (Papert, 1980; Papert & Harel, 1991). Building on these ideas, scholarship on the maker movement has highlighted the educational value of play, tinkering, and hands-on creation as pathways for transdisciplinary STEM learning, including through material-based computational play that extends beyond coding (Gravel et al., 2022). This tradition has been extended through research on maker education, particularly in the work of Halverson and Sheridan (2014), Blikstein (2013), Kafai & Burke (2014), and Fields et al. (2018), as well as studies examining how makerspaces support STEM learning across different educational contexts, including the preparation of future STEM teachers (Rouse et al., 2026). Making is generally understood as learning through doing, where the creation of tangible artifacts supports the development of knowledge, skills, and ways of thinking (Papert & Harel, 1991; Blikstein, 2013).

Over the past two decades, making has moved from informal settings such as garages, community workshops, and computer clubhouses into formal school environments (Halverson & Sheridan, 2014; Blikstein, 2013). In doing so, it has broadened understandings of where and how learning takes place, drawing attention to forms of knowledge construction that occur beyond the classroom. As Halverson and Sheridan (2014) argue, making moves across formal and informal contexts in ways that few pedagogical approaches do, and this mobility is central to its educational significance. Yet the movement of making into schools raises important questions about what happens when a practice rooted in voluntary participation and experimentation enters institutional

settings shaped by assessment and accountability.

Learning in making environments cannot be assumed to operate in the same way as learning in school settings (Halverson & Sheridan, 2014; Lave & Wenger, 1991). Makerspaces are often described as communities of practice, where participation is fluid, expertise is distributed, and individuals move in and out of activities over time (Lave & Wenger, 1991). Existing scholarship on maker learning similarly highlights collaborative participation and the social organisation of activity in these environments (Halverson et al., 2018). Work across STEM education has also drawn attention to participatory approaches that create opportunities for learners to engage actively with meaningful problems across formal and informal settings (Caballero Barragán, 2025). Studies of informal STEM learning further highlight the role of curiosity and engagement in shaping learners' experiences beyond conventional classroom environments (Kent, 2025). These conditions differ from those of formal schooling, which is typically structured around assessment, fixed participation, and the evaluation of individual performance (Black & Wiliam, 1998; Wiliam, 2011). When making enters schools, it is reframed by institutional expectations surrounding curriculum, assessment, accountability, and performance (Blikstein, 2013; Philip et al., 2017). These expectations influence how making is experienced by learners, shaping the meanings attached to competence, participation, and error.

Research on making in education has examined a wide range of outcomes, including skill development, identity formation, and the design of learning environments (Blikstein, 2013; Fields et al., 2018). Other researchers have examined questions of participation, identity, and equity in relation to making and STEM learning, drawing attention to how educational environments shape access, belonging, and whose forms of participation are recognized and valued (Calabrese Barton et al., 2014; Riley, 2008). More recent work on maker and hacker spaces has extended these concerns by examining how practices within such environments can support or constrain the participation of groups traditionally underrepresented in STEM (Riley et al., 2017; Masters et al., 2018). Less attention, however, has been paid to how learners experience these environments in the moment, when considering visibility, judgement, and the management of error. While we know a great deal about what students make and what they learn, we know comparatively less about how they navigate moments of uncertainty and how those experiences are shaped by the institutional conditions of the learning environment.

This paper builds on existing scholarship by examining how these conditions are experienced in practice, with particular attention to how learners interpret and respond to moments of not knowing, especially when those moments are visible to others and open to evaluation.

Emotional Engagement, Affect, and Learning Under Conditions of Uncertainty

Learning is both a cognitive and an emotional process, as learners' emotions influence how they interpret challenges, regulate their engagement, and respond to uncertainty (Immordino-Yang & Damasio, 2007; Pekrun, 2006). Findings on student engagement also recognize that its behavioral, cognitive, and emotional dimensions are closely connected and shaped through learners' interactions with their classroom environments (Fredricks et al., 2004). Across the learning sciences, emotions are understood as integral to persistence, engagement, and understanding, especially when learners encounter difficulty or uncertainty (Immordino-Yang & Damasio, 2007; Schutz & Pekrun, 2007). Studies in STEM education further points to the importance of confidence, motivation, enjoyment, and belonging in shaping how learners engage with hands-on learning experiences (Maiden et al., 2025). Emotion is therefore part of how learners interpret tasks, respond to challenges, and decide whether to continue or withdraw.

This becomes especially visible in situations where performance is open to judgement. In classroom environments structured around assessment, learners are not only working on a task; they are also being evaluated on their performance. Work in classroom assessment has long shown that evaluative structures shape student engagement as well as learners' emotional experiences during moments of error or difficulty (Black & Wiliam, 1998; Wiliam, 2011). Research on classroom emotions further indicates that the emotional climate established by teachers and classroom interactions influences how learners participate, persist, and respond when learning becomes challenging (Meyer & Turner, 2002; Turner & Patrick, 2004).

Studies in STEM classrooms also show how the broader framing of curriculum and pedagogy can shape learners' emotional relationship with what they are learning. Ausman and James (2025), for example, found that students' experiences of STEM could be associated with anxiety and disconnection, while changes in teaching and assessment practices created greater opportunities for engagement and student voice. This reinforces the importance of attending to the conditions surrounding learning, as the same subject or activity may be experienced differently depending on how participation, knowledge, and competence are organized within the environment.

In this literature, emotion is increasingly understood as central to how learners navigate complex tasks, especially in STEM and design contexts where problem solving involves iteration, failure, and revision. However, the relationship between these emotional dynamics and the visibility of learners' work warrants further attention, particularly when learners are observed by others while navigating uncertainty and making errors.

The visibility of difficulty plays an important role in how learners experience and respond to challenges. In making environments, uncertainty, revision, and failure often unfold in ways that are visible to others, making the process of learning itself open to observation. The emotional meaning of these moments depends on the context in which they occur. In some settings, uncertainty may be understood as a natural part of learning, whereas in others it may be interpreted as evidence of limited ability or inadequate preparation (Dweck, 2000). These interpretations influence whether learners seek support, persist with challenging tasks, or withdraw from them.

Classroom research documents that learners' willingness to participate, ask questions, and reveal incomplete understanding is influenced by the social norms established in the learning environment (Meyer & Turner, 2002; Turner & Patrick, 2004). These norms help determine whether uncertainty is treated as an acceptable feature of learning or as something that invites judgement. Findings on academic emotions further demonstrate that learners' interpretations of such achievement situations shape the emotions they experience and the actions they take in response (Pekrun, 2006; Pekrun et al., 2007). Together, this body of work points to the importance of understanding how learners interpret moments of visible difficulty and how those interpretations are shaped by the conditions of the learning environment. This relationship between emotion and interpretation is important in making environments, where uncertainty, revision, and failure are often expected features of the creative process. In informal maker spaces, learners frequently encounter problems without the immediate pressure of formal evaluation, allowing mistakes to function as information that guides further experimentation (Halverson & Sheridan, 2014; Blikstein, 2013). Around formal educational settings, however, making occurs alongside institutional expectations around correctness, performance, and assessment. As a result, the same act of encountering difficulty may be experienced differently depending on the meaning attached to the environment and the learner's position within it.

Self Determination Theory: Autonomy, Competence, and Relatedness in Making

Self Determination Theory (SDT) provides a useful framework for understanding how learning environments influence learners' motivation, engagement, and responses to challenges. Developed by Deci and Ryan (1985, 2000), the theory proposes that human motivation is shaped by the fulfilment of three basic psychological needs: autonomy, competence, and relatedness. Autonomy refers to the experience of having choice and agency in one's actions, competence concerns the feeling of effectiveness and capability when engaging with tasks, and relatedness reflects the sense of connection and belonging in a

social environment.

In educational contexts, SDT suggests that environments that support these needs are more likely to encourage deeper engagement, persistence, and intrinsic motivation, while environments that limit them may influence how learners interpret and respond to challenges (Deci & Ryan, 2000; Ryan & Deci, 2017). This perspective helps explain why making environments can produce different experiences for learners, as making often involves choice, experimentation, and iterative problem solving. Learners are frequently required to make decisions, encounter setbacks, revise their ideas, and develop solutions through sustained engagement with materials and problems.

However, the extent to which making supports these psychological needs depends on the environment in which it occurs (Han et al., 2017; Niemiec & Ryan, 2009). Informal makerspaces often provide learners with greater autonomy over what they create and how they approach problems, while also allowing competence to develop through experimentation and revision (Ryan & Deci, 2017; Halverson & Sheridan, 2014). When making is situated in a formal educational setting, these experiences may be shaped by institutional expectations surrounding curriculum, assessment, and performance. The same activity can therefore produce different emotional and motivational experiences depending on whether learners experience making as something they own, something they are evaluated on, or something they are expected to complete.

The Affective Conditions of Making: Locating the Gap

Empirical work on maker education has provided important insights into how learners develop skills, construct knowledge, participate in communities, and engage with tools and materials. Studies have examined the role of making in supporting creativity, problem solving, identity development, and collaborative learning (Blikstein, 2013; Halverson & Sheridan, 2014; Kafai & Burke, 2014). Other work has explored issues of participation, access, and equity, drawing attention to how maker environments shape who participates and how learners position themselves in these spaces (Calabrese Barton et al., 2014).

Scholarship has provided valuable insights into what learners create, what they learn through making, and how making environments are designed to support participation and learning (Halverson & Sheridan, 2014; Blikstein, 2013; Kafai & Burke, 2014; Vossoughi et al., 2016; Peppler & Bender, 2013). How learners experience making in difficult moments, when they are uncertain, when their struggle is visible, and when revision is required, is a question the literature has not examined in depth. (Maltese et al., 2018; Vongkulluksn et al., 2018).

These moments are integral to making, where ideas often remain

unfinished, attempts do not always succeed, and solutions emerge through repeated experimentation. How learners interpret such experiences depends not only on the task at hand but also on the social and institutional conditions in which making takes place.

The distinction between formal and informal making environments is important in this regard. Informal maker spaces often provide opportunities for voluntary participation, experimentation, and self-directed exploration, while formal educational settings operate around structures of assessment, curriculum expectations, and accountability. Although research has examined formal and informal making environments and how educators respond to failure during making activities, less is understood about how institutional expectations shape learners' emotional responses to uncertainty, visible mistakes, and persistence (Halverson & Sheridan, 2014; Maltese et al., 2018).

This paper addresses this gap by bringing the question of how learners experience making across two different learning environments emotionally into STEM education research. Two teaching contexts structure the analysis, a formal technical drawing classroom and an informal maker workshop, through which the paper examines how the affective conditions of making differ across various learning environments and what produces those differences. Learners' experiences of uncertainty, correction, and persistence are the entry point through which the paper examines how institutional framing determines whether making is experienced as exploration or as performance under evaluation.

Having established the need to understand how learners experience uncertainty and difficulty across different making environments, the following section explains the methodological position through which these experiences are examined.

METHODOLOGICAL POSITIONING

This paper adopts an interpretive practitioner inquiry approach. The analysis is built from reflective accounts of my own teaching practice across two educational contexts: a formal secondary school technical drawing classroom in Abuja, Nigeria, and an informal makerspace workshop in Dubai, United Arab Emirates. Over seven years, including four years in Abuja and three in Dubai, I designed learning activities, supported learners through making tasks, and observed their responses to uncertainty, error, and revision. Practitioner inquiry treats professional experience as a source of educational knowledge through systematic reflection on teaching and learning (Schön, 1983; Cochran-Smith & Lytle, 2009).

Lesson plans and teaching records provided contextual information about the instructional settings. The episodes themselves draw on different sources:

retrospective recollection and subsequent discussion with Manu, and documentation produced during my teaching practice in Nuhu's case. I selected these episodes purposively because they illustrate a question that recurred in my practice: how do learners respond when difficulty becomes visible? The selection was analytic, not intended to represent learners in either setting.

Manu's episode was reconstructed from memory after he had left the school. Before using it in this paper, I informed him of the intended academic use and obtained his agreement. Our subsequent discussion also informed my interpretation. Similar responses, including hesitation, withdrawal, and attempts to conceal mistakes, also occurred among other students. These observations helped shape the research question but were not systematically collected and are not treated as comparative empirical evidence. Manu's account is therefore presented as a situated illustration, not as evidence representative of the wider class.

Nuhu's episode was documented during my work at the Dubai workshop. Although the workshop had procedures for documenting children's activities, these did not constitute consent for observational research. The account is presented under a pseudonym, with identifying details removed; no photographs, recordings, or other identifying materials are included. The episodes thus have different evidentiary histories and are not treated as equivalent forms of data.

The analysis interprets each episode as a situated educational experience, attending first to observable actions and interactions before considering their possible meanings within the learning environment. Concepts from maker education, academic emotions, student engagement, and Self-Determination Theory inform this interpretation (van Manen, 2016). A distinction is maintained between observation and inference. For example, Manu turning his paper face down is observable; interpreting the action as a response to a visible mistake, anticipated evaluation, or a perceived threat to competence is inferential. My contextual knowledge and subsequent discussion with Manu inform this interpretation but do not provide direct access to his emotional state. Similarly, Nuhu's persistence and visible satisfaction are interpreted as possible indicators of engagement, not definitive evidence of his internal experience.

My dual role as teacher and researcher shaped both the accounts and their interpretation. Direct involvement gave me contextual knowledge of instructional routines, expectations, learner participation, and material practices. It also influenced which moments I noticed and how I understood them. My background in technical and technology education, alongside my engagement with scholarship on making and emotion, informed the questions through which I revisited these experiences. The accounts are therefore

situated practitioner interpretations rather than neutral observations (Schön, 1983; Cochran-Smith & Lytle, 2009).

The comparison is an analytic contrast, not a controlled comparison of formal and informal education. The learners differed in age, and the activities, cultural contexts, assessment conditions, project ownership, task structures, prior experience, learner characteristics, and instructor interactions were also different. These factors may have contributed to their responses. Institutional framing is therefore treated as one possible influence among several, rather than as the sole cause of the differences observed.

The purpose of the analysis is to develop conceptual insight into the affective conditions of making and identify processes that may be relevant to similar educational situations. The two episodes cannot establish causal relationships, support statistical generalization, or disentangle the contextual factors shaping each learner's experience. Their value lies in the close interpretation of particular experiences and the conceptual questions these raise for further inquiry (Flyvbjerg, 2006; Tracy, 2010). The claims are consequently bounded interpretations of how learning environments may shape responses to uncertainty, difficulty, revision, and error.

Ethical Considerations

The paper was developed retrospectively from teaching practice rather than from a study designed prospectively to collect research data from learners. Both learners are identified by pseudonyms and identifying details have been removed or limited to those necessary to explain the educational contexts.

Manu's episode was reconstructed from memory after he had left the school. I informed him of the possible academic use of the account, obtained his agreement, and discussed the episode with him. His pseudonym and the removal of identifying details provide additional protection for his identity.

Nuhu's episode originated in my teaching practice at the Dubai workshop and was documented at the time. The workshop's documentation procedures did not constitute consent for observational research, and individual parental consent for using this episode in research was not obtained. The account is therefore restricted to a brief, anonymized description of the learning interaction. No photographs, recordings, or other identifying materials are included.

No formal research ethics review was sought for the original teaching activities. The episodes were subsequently revisited as material for interpretive reflection, rather than generated through a prospectively designed study involving recruitment, interviews, or systematic observation of minors. These circumstances define important ethical and methodological limits. Anonymization does not itself resolve questions about the use of a child's

experience in research, and the absence of individual parental consent remains a limitation of the Nuhu account.

The analysis does not claim direct access to either learner's internal emotional state or evaluate the learners themselves. It examines how particular educational conditions may shape the meanings attached to difficulty, error, visibility, competence, and participation. The episodes are used as bounded practitioner accounts to explore these conceptual questions, not to support generalizations about children, institutions, or cultural contexts.

ANALYSIS AND DISCUSSION

Making as Performance: Visibility, Competence, and the Risk of Error

Making in the technical drawing classroom involved producing work that remained visible to the teacher and classmates. Construction lines, erased marks, and completed drawings made students' progress open to inspection. Although this visibility served the practical demands of technical drawing, it also created conditions in which errors could be interpreted as evidence of competence. The issue is not visibility itself, but the meanings attached to visible performance within an assessed learning environment.

Manu's response illustrates this tension. After noticing an incorrect top view, he turned his paper face down, temporarily concealing the drawing rather than correcting it. His prior experience suggested that he had the knowledge needed to resolve the error, yet his immediate response was directed towards managing its visibility. One possible interpretation is that the mistake threatened the competent image associated with his consistently strong performance. Embarrassment, frustration, or a preference to correct the drawing privately are also plausible explanations. The episode cannot establish his precise emotional state, but it illustrates how responding to an error may involve concerns beyond its technical consequences.

Pekrun's (2006) account of achievement emotions offers a framework for considering how perceived control and the value attached to performance may shape responses to difficulty. Self Determination Theory similarly identifies competence as a basic psychological need relevant to motivation and engagement (Deci & Ryan, 2000; Ryan & Deci, 2017). From these perspectives, Manu's response raises a question about how competence is understood in an assessed classroom. If successful performance becomes closely associated with being a capable student, an error may be experienced as a threat to that identity. Yet competence also involves recognizing and correcting mistakes. The tension lies in whether the learning environment makes this process compatible with being seen as capable.

The subsequent interaction offers a useful illustration. Rather than identifying the error directly, I asked Manu to trace the cylinder's path through

the object. He reconsidered the drawing, located the misplaced hidden lines, and began correcting them. This interaction redirected attention towards the problem and allowed him to work through it using his own reasoning. It cannot establish that his emotional discomfort disappeared, but it illustrates how an instructor's response may create space for re-engagement without making the error itself the focus of attention.

This case supports a conceptual distinction between making errors visible for learning and making their visibility socially consequential. Assessment can clarify expectations and support improvement; it does not inherently discourage engagement. However, when learners perceive mistakes as judgements of their capability, the conditions intended to support learning may also make participation more difficult. Manu's episode brings this tension into view without establishing that it characterizes the classroom or formal education more broadly.

Making as Choice: Autonomy, Ownership, and Learning Through Iteration

Nuhu's experience offers a contrasting illustration. He chose to build a maze for his hamster and developed an idea of the intended outcome before construction began. The project therefore had personal significance, and the measurements, cuts, and adjustments served a goal he valued. This ownership provides one possible explanation for his persistence, though it cannot account for his response on its own.

When the cuts proved uneven and the walls failed to align, Nuhu examined the pieces, turned them over, sketched another approach, and continued working. His actions suggest sustained engagement with the construction problem. Unlike Manu, he did not visibly attempt to conceal the difficulty. However, the absence of concealment does not establish that he felt no frustration or concern about others' perceptions. The cases provide different observable responses, not directly comparable measures of emotional experience.

Self Determination Theory helps explain how personal ownership may support engagement. Autonomy concerns acting with a sense of volition and personal endorsement, rather than simply having freedom from direction (Deci & Ryan, 2000; Ryan & Deci, 2017). Nuhu's choice of project may have supported his willingness to persist because solving the problem served an outcome he valued. Nevertheless, interest in the project, prior practical experience, confidence, and the desire to complete the maze may also have contributed. The account does not allow these explanations to be separated.

Constructionist perspectives provide a complementary lens. Papert (1980) and Papert and Harel (1991) emphasize learning through the

construction of personally meaningful artefacts. Nuhu's maze illustrates how a tangible project can give revision a clear purpose: adjustments brought the developing structure closer to the intended design. The workshop appeared to accommodate this iterative process, allowing the activity to continue as the design changed. This does not mean that personal choice or making an artefact guarantees productive learning. Projects can generate frustration, and learners may need additional guidance when technical difficulties persist.

Nuhu's smile as he examined the completed section is consistent with satisfaction in the outcome, but it cannot establish the precise source of that satisfaction. It may have reflected pride, relief, or pleasure in seeing his idea take shape. The workshop also involved constraints, including material limitations and the demands of accurate construction. Its significance for this analysis lies not in the absence of difficulty, but in the apparent availability of revision as a way to respond to it. This episode thus illustrates how ownership and opportunities to modify a design may support continued engagement, without demonstrating a causal relationship between autonomy and persistence.

Institutional Framing and the Affective Conditions of Making

The two episodes provide a basis for a conceptual argument about institutional framing: learners' experiences of making may be shaped by the expectations, assessment practices, and forms of participation through which educational settings communicate the meaning of competence and error. The cases do not establish a general difference between formal and informal environments. Instead, they help examine how the organisation of an activity may influence the significance learners attach to difficulty.

Manu's concealment of his drawing and Nuhu's continued revision suggest different ways of responding when work does not proceed as intended. In the first episode, visible performance and the possibility of evaluation may have heightened the significance of an error. In the second, project ownership and the opportunity to revise may have supported continued engagement. These interpretations are consistent with the theoretical perspectives discussed above, but the episodes cannot show that institutional framing alone produced the differences.

The comparison has important limits. The learners differed in age, the tasks involved different technical processes, and the episodes occurred in distinct cultural and educational contexts. Project ownership, assessment conditions, prior experience, learner characteristics, and instructor interaction also differed. Since the cases were selected retrospectively from teaching practice rather than drawn from a systematically collected dataset, they cannot establish how frequently these responses occur or whether similar patterns

characterize either setting. Institutional framing is therefore an interpretive lens for examining the episodes, not a demonstrated causal explanation.

This distinction complicates the assumption that introducing maker activities, digital fabrication, or project-based learning into schools will reproduce the conditions associated with informal making. Similar tools and activities may be organized around different expectations of performance, evaluation, and participation. A school-based making project may retain strong assessment pressures, while an informal workshop may impose its own standards and constraints. The conceptual issue is therefore not whether one setting is inherently more supportive, but how each setting structures learners' opportunities to make decisions, encounter errors, and revise their work.

Self Determination Theory further helps distinguish autonomy from competence and relatedness (Deci & Ryan, 2000; Ryan & Deci, 2017). Choosing what to make may support autonomy, but learners also need opportunities to experience themselves as capable and to participate meaningfully with others. Nuhu's project illustrates the possible value of ownership, while Manu's correction illustrates how a learner may exercise competence within an assessed task. Neither episode demonstrates that autonomy belongs to informal learning or that assessment necessarily undermines competence. Instead, they point to the relationship between these needs and the conditions of making warrants closer attention.

For educators, the conceptual argument directs attention beyond access to tools and projects. The ways teachers respond to errors, structure participation, allow revision, and communicate expectations may influence how learners approach difficulty. Treating mistakes as information, supporting learners' own reasoning, and allowing time for revision are possible ways to make error compatible with learning. These are pedagogical implications drawn from the interpretation, not interventions whose effects have been tested in this paper.

The contribution of the two cases is thus conceptual rather than empirical in the sense of establishing generalizable findings. They illustrate how making may be experienced as performance, exploration, or a combination of the two, depending partly on the meanings attached to competence, error, and participation. Further research using systematic observation and a broader range of learners and settings would be needed to examine how these relationships operate across contexts.

CONCLUSION

This paper advances a conceptual argument about how institutional framing may shape the emotional conditions of making. Through two illustrative teaching episodes interpreted using Self Determination Theory and

constructionism, it examines how assessment, project ownership, and opportunities for revision may influence the meanings learners attach to difficulty. The cases do not establish general patterns across formal and informal education; they make a set of theoretical questions visible through particular experiences.

Manu's decision to conceal his drawing and Nuhu's persistence with the hamster maze illustrate contrasting responses to technical difficulty. These actions may reflect differences in how visible mistakes, personal ownership, and revision were situated within their respective learning activities. However, the learners' different ages, tasks, experiences, and educational contexts prevent the contrast from being attributed to institutional framing alone. Nor can the accounts establish the learners' internal emotional states with certainty.

The practical implication is not that formal assessment should be abandoned or that informal making is inherently more supportive. It is that educators should consider how their expectations and responses to errors shape the conditions under which learners work through uncertainty. Access to tools and projects matters, but so do opportunities to revise, exercise judgement, seek support, and demonstrate competence through the process of correcting mistakes.

The two episodes do not answer conclusively when learners feel able to remain engaged with uncertainty. They offer a conceptual starting point for investigating how educational environments make error, competence, and participation meaningful. Further research across a wider range of learners and settings is needed to examine these relationships systematically.

Generative AI Statement:

The author employed ChatGPT to refine the language. The author has reviewed and edited the content and accepts full responsibility for the contents of this publication.

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Bio

UCHECHUKWU EKWUEME-DURU is an educator and researcher whose interests include STEM education, technical learning, curriculum development, making, higher education, learner engagement, and emotional experiences across formal and informal educational environments.
Email: S24011847@mail.glyndwr.ac.uk