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Productive adaptation: Mushfaking as a transformative tool for sustainable higher education in metapedagogy

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Abstract

Higher education in the Global South functions within a growing polycrisis, and to address this, this study uses the concept of *mushfaking* (Foster, 1982; Gee, 1996), as a compensatory survival tactic, and develops it into a formal, African-centric metapedagogical framework grounded in affirmative ethics (Braidotti, 2013) and metamodernist praxis (Vermeulen & Van den Akker, 2010). A design-based action research model was employed over three authentic, iterative cycles within a first-year digital photography learning unit. The first (unsuccessful) cycle comprised a digital pinhole initiative, in which students constructed and operated simplified pinhole cameras. The second cycle was successful and was followed by a subsequent 3D-printed pinhole camera cycle. The study drew on pre-course surveys (N = 123), focus group discussions, and the critical analysis of student-created artefacts and reflective journals using a mix of methods, which enabled a triangulated assessment of pedagogical influence within a severely constrained teaching and learning environment. Findings demonstrate that mushfaking can function as a powerful agent of transformative learning. Students transitioned from passive consumers of proprietary technology to active, resourceful bricoleurs. They developed technical and visual competencies, and critical, adaptive, and collaborative multiliteracies essential to professional practice. Evidence further points to a meaningful shift in identity formation, with students beginning to embody a resilient, Ubuntu-informed practitioner self. The three cycles suggest that deliberately constrained, action-based curricula can cultivate equity, access, and environmental consciousness in ways consonant with quality education and reduced inequalities offering a promising pathway for sustainable, decolonial higher education practice under polycrisis conditions.

Keywords: mushfaking, photography, Africanisation, metapedagogy, multiliteracies, curriculum

Introduction

Higher education institutions in the Global South operate within Morin and Kern's (1999) seminal conceptualisation of *polycrisis*, the simultaneous, compounding occurrence of several catastrophic pressures at the macro level. More recently, Tooze (2021) revived and sharpened this concept, warning that a polycrisis is not a singular catastrophic event but rather a tangled web of simultaneous, mutually reinforcing shocks. In the context of higher education in South Africa, this takes the form of a confluence of severe economic constraints, systemic historical inequality, fragile energy infrastructure, and rapid technological alienation (Mateko et al., 2025). While navigating these intersecting volatilities, universities must produce graduates who are technologically savvy and globally competitive. This fact is often overlooked by established educational paradigms in design education, especially photographic education, which mainly rely on costly proprietary technologies. These models perpetuate discriminatory practices carried over from colonial educational institutions by placing students from families with limited socioeconomic resources at a structural disadvantage (Ndlovu-Gatsheni, 2022). Ajani (2024) reinforces this, demonstrating that equity failures in Southern African higher education are not incidental but structurally reproduced through curriculum and resource assumptions inherited from colonial models. This structural reproduction demands more than an incremental adjustment. Ajani argues that curriculum reform in African higher education must be explicitly reoriented toward solving societal problems, a mandate that moves the decolonial project from rhetorical aspiration to material practice.

For first-year students, these pressures manifest at three intersecting levels: infrastructural, economic, and affect. Infrastructurally, students are required to operate within increasingly demanding technological learning environments that assume access, fluency, and stability. These conditions remain precarious at best. When infrastructural failures intersect with what Brenner and Theodore (2002, p. 353) describe as the geographically uneven realities of "actually existing neoliberalism," the digital turn in higher education risks producing, rather than alleviating, new forms of exclusion. Czerniewicz (2018) identifies this dynamic precisely, showing that online transitions in higher education structurally reproduce digital inequalities rather than resolve them, particularly in Global South contexts—echoed by Nthambeleni and Motadi (2025) and Mokofe (2025) seven years later. Framed as progressive, reliance on proprietary digital ecosystems frequently mirrors and compounds older structural inequalities (Ndlovu-Gatsheni, 2022), thereby rendering the polycrisis a lived, daily pedagogical barrier. Pangrazio (2016) sharpens this critique in the educational domain, arguing that digital literacy frameworks uncritically assume access conditions that marginalised students structurally do not possess. The discourse continues, employing much the same rhetoric and terminology, for example, Wallengren-Lynch (2026) uses the phrase "towards a framework for digital literacy" in the title of his article.

Economically, this situation is made worse by data expenses. Students must constantly manage connectivity costs when they are off campus because the curriculum increasingly relies on online platforms, cloud-based materials, and digital submission mechanisms. In addition to intellectual engagement, participation in learning depends on stable network coverage, data

availability, and devices with the right specifications. Bawden (2008) historicises this further, tracing how the concept of digital literacy has been constructed in ways that obscure its structural preconditions, rendering invisible the material inequalities that determine who can participate. This is not only an economic problem but an epistemological one: the curriculum's assumptions about legitimate photographic knowledge are themselves shaped by the same colonial logics that determine access to equipment. These students are negotiating the psychological demands of adjusting to the teaching and learning experiences of the higher education system at the same time. In addition to navigating different institutional cultures, students must develop social networks and adjust to new academic requirements. Learning is frequently disrupted, postponed, or experienced unevenly as a result of the accumulation of these influences.

Therefore, the teaching and learning venue cannot be understood as a contained site of constructing new meaning. The teaching and learning venues become a node within a broader system of instability and constraint. As a facilitator of learning, one can design learning opportunities with care and intention; however, their effectiveness remains deeply dependent on an uneven network of institutional support systems. This study challenges the deficit narrative surrounding this polycrisis by introducing *mushfaking* as a formal, transformative pedagogical tool that generates actionable pathways of hope and positive learning experiences. Against this backdrop, the study investigated how a deliberately constrained, mushfaking-oriented curriculum design within a first-year digital photography unit can function as a transformative pedagogical tool in a resource-scarce South African higher education context. More specifically, the research question guiding the three design-based action research (DBAR) cycles is: "How does the operationalisation of mushfaking through the digital pinhole and 3D-printed pinhole camera initiatives shape students' multiliteracies, experiences of technological anxiety, and emerging practitioner identities in a polycrisis environment?"

The term mushfaking was originally documented by Foster (1982) as a compensatory coping behaviour among prisoners, referring to the creative repurposing of restricted materials for survival. Gee (1996) subsequently transposed this concept into sociolinguistics, applying it to marginalised groups navigating dominant discourses. More recently, Faltis (2014) extended its application to academic language acquisition, observing how students in constrained contexts deploy mushfaking-like strategies to navigate institutional demands. In this study, mushfaking is elevated from a compensatory survival tactic to a strategic curriculum initiative driven by affirmative ethics. Set within a first-year digital photography study unit, this study documents the implementation of the digital pinhole initiative. This curriculum redesign initiative required students to construct and operate simplified pinhole cameras rather than relying on sophisticated digital single-lens reflex (DSLR) cameras. The digital pinhole initiative sought to strip some of the automation found in DSLR cameras to achieve the same basic settings. This study argues that when framed through a metapedagogical lens, such deliberately imposed constraints force productive adaptation. They shift the educational focus from passive consumption of technology to active, critically conscious creation of learning tools, fostering the creativity required to navigate contemporary educational challenges.

Theoretical framework: Metamodernism, affirmative ethics, and transformative learning

The theoretical grounding lies at the intersection of metamodernism, affirmative ethics, and metapedagogy as found in transformative learning. Metamodernism oscillates between modern enthusiasm and postmodern irony, demanding pragmatic, action-oriented, and socially conscious approaches (Vermeulen & Van den Akker, 2010). This oscillation between hope and critique is not merely philosophical; Schön (1983) grounds it in professional practice, arguing that the reflective practitioner is defined precisely by their capacity to hold uncertainty and action in productive tension. He brought a deeper meaning to the discourse on reflexivity as a unit of analysis. He extended our understanding of reflection beyond an act that focuses retrospectively on what has happened, highlighting the different stages of reflection instead: reflection-in-action, reflection-on-action, and reflection-before-action. Scholars such as Harvey et al. (2025) take this discourse to a meta-level by reflecting on reflective practice itself, while constructs such as meta-reflection have also emerged (du Toit, 2018).

In an era of a polycrisis, education cannot rely on unsustainable models of endless resource consumption. It must respond to urgent global imperatives including human rights, environmental sustainability, and sociocultural inclusivity. To navigate this terrain, this study draws on Braidotti's (2013) concept of affirmative ethics. Rather than dwelling on vulnerability and lack, affirmative ethics focuses on generating productive and creative alternatives that sustain life and hope. Metapedagogy answers this call by questioning how knowledge and tools are produced in the classroom. This study elevates mushfaking to a formal metapedagogical strategy. In Braidotti's (2013) lens of affirmative ethics, mushfaking ceases to be a survival mechanism or symptom of deficit and instead becomes a generative, transformative act that refuses pedagogical despair. By integrating this affirmative stance with Freirean (1970) critical pedagogy, which actively dismantles the passive banking concept of learning, mushfaking creates opportunities for students to self-empower, to stop consuming imported technological solutions, and to creatively hack them. Kress (2010) reinforces this imperative from a multimodal perspective, arguing that meaning-making in contemporary communication demands an active, designing subject rather than the passive recipient produced by the banking model.

Significantly, this convergence between Braidottian affirmative ethics and Freirean critique is not an exclusively European theoretical import. Scholarship of South African Ubuntu pedagogy arrives at a structurally parallel position from within African philosophy. Ngubane and Makua (2021) argue that Western pedagogies enacted in South African higher education produce what Ndlovu-Gatsheni (2018) terms epistemic violence, a systemic dismissal of Indigenous knowledge systems that generates habituated orientations of inadequacy. In Ngubane and Makua's (2021) framework, Ubuntu pedagogy is positioned not as a cultural supplement to existing practice, but as an alternative to current pedagogies that draws from African philosophy to cultivate equity, recognition, and fair participation. The mushfaking framework, grounded in affirmative ethics, operates in parallel; it refuses to accept deficit as the terminal condition of the constrained classroom and instead generates the conditions for

what Ubuntu philosophy names as collective human flourishing. Bringing these two bodies of scholarship into dialogue demonstrates that theoretical pluralism is not eclectic but convergent. European posthumanism and African Ubuntu scholarship independently identify the same structural problem and demand the same generative response.

Students who are deprived of automated technological solutions experience what Mezirow (1991, p. 167) defines as a "disorienting dilemma." This is a pedagogical disruption that forces a critical re-evaluation of students' relationship with technology, prompting a transformative shift from dependency to agency. Kolb (1984) provides a structural complement to Mezirow's framework, mapping how reflection on concrete experience drives conceptual transformation through iterative cycles of action and review, a process that the three DBAR cycles directly enact. Therefore, mushfaking becomes an African-centric framework. It champions resilience over despair, replacing reliance on imported technological black boxes with localised, hands-on ingenuity.

However, the Africanisation of the curriculum is not simply a matter of geographical or cultural representation. As Ndlovu-Gatsheni (2022) argues, it is a fundamentally epistemological project, requiring the deliberate dismantling of what he terms global coloniality: the persistent structuring of knowledge production according to the priorities and logics of the Global North. Le Grange (2014) extends this argument, insisting that Africanisation must engage curriculum as an active force, what he terms currere, rather than a static revision of content. Letsekha (2013) cautions, however, that Africanisation risks becoming tokenistic unless grounded in a conceptual shift that seriously interrogates whose knowledge counts as valid and on whose epistemological terms. In photography education, this coloniality is embedded in the assumption that access to Northern-manufactured, proprietary technology is required for legitimate visual practice. In this light, metapedagogy becomes a site of epistemic resistance; by refusing to accept the terms under which photographic knowledge is typically transmitted, the mushfaking framework practises what Freire (1970) envisioned as a genuinely dialogical education—one in which the conditions of learning are subjected to critical interrogation. The curriculum does not merely accommodate the constraints of the Global South; rather, it elevates them as pedagogically productive, insisting that localised ingenuity constitutes a legitimate and generative form of knowledge-making. Fataar (2025) deepens this position, arguing for contrapuntal curriculum reform as epistemic transformation, a pedagogical practice that holds dominant and marginalised knowledge systems in simultaneous view rather than simply replacing one with the other. This positions the study not only as a practical response to resource scarcity but also as a contribution to the broader decolonial project of redefining what constitutes a valid educational practice in higher education in Africa. This caution is sharpened by Hungwe and Ndofirepi (2022), who critically interrogate the paradigmatic assumptions within decolonisation discourse itself, identifying four recurring positions—Africanisation, indigeneity, racial redress, and Ubuntu—and warning against the unexamined entrenchment of any single paradigm. The mushfaking framework is conscious of this risk: its claim to Africanisation rests not on the invocation of a category but on the lived, material enactment of Ubuntu-informed collective practice within the curriculum, a distinction that Fataar's (2025) contrapuntal model helps to clarify.

These three theoretical lenses directly map onto the three phases of the study design. Metamodernism frames the urgency of the problem and the curriculum's orientation. Affirmative ethics, in dialogue with scholarship on Ubuntu pedagogy (Ngubane & Makua, 2021), governs the pedagogical stance during physical initiatives. Mezirow's (1991) transformative learning theory provides an analytical lens for interpreting students' cognitive shifts. And Ubuntugogy (Mthimkhulu, 2024; Yende, 2024) names the relational, collectively organised mode of knowledge-making that the Ubuntu classroom produced in practice. The subsequent sections therefore read students' experiences of technological anxiety, bricolage, and collaborative problem-solving through these convergent lenses. Rather than imposing theory onto the data, the analysis traces how students' own practices of assembling, adapting, and sharing cameras instantiate metamodern oscillation, affirmative ethical responsiveness, and Ubuntu-informed collective flourishing in concrete classroom settings.

Research methodology: DBAR as a stage for creativity

When the macro-level polycrisis infiltrates the university, it translates into classroom-level wicked problems (Rittel & Webber, 1973). Buchanan (1992) extended the wicked problem concept specifically into design thinking, arguing that all design problems are inherently wicked because they resist decomposition into stable, solvable components. Levin et al. (2012) escalate this further with the notion of *super wicked problems*—situations in which the agents tasked with solving a problem are simultaneously implicated in producing it, a condition that maps directly onto the educator embedded within a resource-constrained system. Wicked problems are issues that possess no single, definitive solution because their parameters are constantly shifting. The wicked problem is stark in the context of a first-year photography study unit curriculum. Lecturers must facilitate the learning of a diverse cohort using advanced photography technology and digital literacy, many of whom cannot afford proprietary DSLR cameras, while simultaneously contending with varying levels of camera advancement, making the working base inconsistent. Because wicked problems resist linear, imported educational solutions, traditional pedagogies frequently collapse under shifting infrastructural parameters.

To investigate mushfaking as a viable pedagogical counter-strategy, a DBAR research methodology was adopted. As McKenney and Reeves (2018) argue, design-based approaches are inherently pragmatic and interventionist, shifting the focus of research from mere observation of educational phenomena to active engineering of solutions in the real world. This approach builds on Brown's (1992) foundational argument that design experiments are necessary precisely because complex classroom interventions cannot be adequately understood through observation alone; they require active engineering within real learning environments. Collins et al. (2004) formalised these research methodological requirements, specifying that design research must involve iterative cycles of testing and refinement grounded in authentic educational conditions. Importantly, DBAR is not a research methodology imported wholesale from Northern educational research contexts. Fletcher and Zuber-Skerritt (2008) document its application in South African higher education specifically, identifying six factors critical to its quality in this setting: facilitator expertise, adaptive planning, responsive evaluation, critical events, application, and self-efficacy. Each of these factors is directly operative in the three-

cycle design documented here, and their identification in a comparable South African institutional context grounds the present study's methodological choices in regional precedent rather than universal prescription. In this study, DBAR was implemented across two iterative cycles within a single first-year digital photography learning unit, although it is a single photography unit. The unit is delivered across two separate student cohorts from two different departments. This scope reflects the logistical realities of the programme rather than a conceptual commitment to minimal iteration. Working with multiple teaching staff across communication design and multimedia streams, and negotiating institutional timetables, assessment calendars, and studio availability, made extension into additional cycles within the study period practically difficult. In addition, running multiple cycles would have required at least three to four years to implement. Within these constraints, the two cycles were a direct result of the logistical constraints and deliberately used the affordances to enact Brown's (1992) call for complex classroom interventions that are engineered rather than merely observed, and to align with Fletcher and Zuber-Skerritt's (2008) criteria for high-quality design-based action research in South African higher education settings. Integrating this with the emancipatory goals of action research, DBAR provides an agile, iterative framework capable of responding to the unpredictable volatility of the South African higher education teaching and learning setting, through the design, testing, and refinement of complex interventions across two live action cycles.

Situating the researcher within the DBAR design is an ethical necessity and not merely a methodological convention. Norton (2018) theorises pedagogical action research as necessarily implicating the practitioner within the inquiry itself—the researcher cannot stand outside the conditions they are investigating. Colombo (2003) adds that reflexivity in action research is not an optional methodological quality but constitutive of the knowledge it produces. In this study, the researcher occupied the dual role of learning facilitator and co-investigator, a positionality that carries both productive and reflexive tensions. As McKenney and Reeves (2018) acknowledge, the researcher's proximity to the intervention risks conflating pedagogical aspiration with empirical evidence. This study addressed that risk through deliberate triangulation across multiple data sources. More fundamentally, this dual role reflects a Freirean (1970) commitment to what he termed co-intentional education, in which the educator does not stand apart from the conditions of learning but is immersed within them. The researcher-as-facilitator was not a neutral observer of student constraints, but a practitioner equally embedded in the South African classroom's infrastructure failures, timetable pressures, and resource limitations. This shared situatedness shaped every design decision across the two action cycles, ensuring that the intervention grew from the specific material conditions of the learning environment rather than an external ideal.

Across the two cycles, the learning unit enrolled two cohorts: a multimedia cohort, with a final consenting sample of 32 students from an eligible pool of 60, and a graphic design photography cohort, with a final consenting sample of 49 students from an eligible pool of 60. Pre-course surveys were administered to both cohorts as part of a larger baseline study, with participation voluntary and governed by institutional ethical clearance procedures. Focus group discussions were conducted with purposively selected students who had completed the initiatives, and

reflective journals and photographic artefacts were collected as course-embedded assignments with informed consent. Qualitative data were analysed thematically, with coding categories derived inductively from student narratives and iteratively refined in dialogue with the theoretical lenses of transformative learning, multiliteracies, and Ubuntu pedagogy. Survey data were analysed descriptively to contextualise the prevalence of technological anxiety and equipment access constraints. Together, these procedures constitute the triangulated evidentiary base through which claims about learning, identity formation, and Ubuntu-informed practice are warranted. Linked to this, Cope and Kalantzis (2009), Engelbrecht (2019), and Cazden et al. (1996)—in their seminal work—reiterate the role of multiliteracies in shaping self, practice, and learning.

Limitations and transferability

The study's conclusions are necessarily bound by its design. The two actioned DBAR cycles unfold within a single learning unit at a South African higher education institution, and involved a limited cohort of first-year students from two different departments. While this setting is characteristic of many resource-constrained higher education environments, the findings should be read as contextually grounded rather than universally generalisable. They offer an empirically tested pathway of reconfiguring photographic curricula under conditions of scarcity, rather than a definitive model of systemic transformation across the sector. Future research could extend the cycles into additional units, programmes, and institutions, as well as track longitudinal impacts on graduate trajectories.

The initiative: The digital pinhole initiative and demystifying the apparatus

The operationalisation of mushfaking within the curriculum required a deliberate dismantling of technological privilege through bricolage. Bricolage is the intellectual and physical act of tinkering with whatever materials are immediately at hand to construct a viable solution. In contemporary photography education, the camera is often treated as an opaque, unquestionable apparatus. Flusser (2000) famously warned that the modern camera operates as a black box programmed to execute complex calculations instantaneously, thereby reducing the user to a mere functionary of the machine algorithms. Barthes (1993) deepens this, arguing in *Camera Lucida* that the photographic apparatus carries an ideological charge that exceeds its mechanical function—it shapes not only what is recorded but how the image-maker understands their own relationship to reality. Edwards (2006) historicises this mystification, tracing how photographic technology has been systematically obscured to serve commercial and institutional interests. In the context of the Global South, this technological alienation closely mirrors Freire's (1970) critique of the banking concept of education, where students passively receive pre-programmed outputs rather than actively constructing knowledge.

The digital pinhole initiative deliberately stripped away this algorithmic automation. The curriculum shattered the black box by forcing students to become bricoleurs, demanding that they reclaim their epistemic agency over the fundamental physics of light, optics, and

chemistry. Implementing this initiative presented significant pedagogical complexities, requiring students not only to trust an unfamiliar process but also to accept a radically different paradigm of image-making.

The three iterative cycles are outlined below; the first cycle was by no means a success. However, to give the reader an idea of the entire process, the inclusion of this cycle authenticates the DBAR.

Cycle 1: Commencing with the camera building process—a trial run

During the first two weeks of the initial seven-week curriculum implementation, students were introduced to the digital pinhole initiative, in which students were introduced to the principles of pinhole photography through the collaborative construction of improvised cameras using readily available materials such as DSLR cameras, DSLR body caps, aluminium, duct tape, and other low-cost items. Thus, Week 1 was intended for making digital pinholes and Week 2 was meant to be for the assembly of 3D printed cameras building on lessons learnt from repurposing the DSLR cameras. However, delays in the printing of the 3D-printed cameras compounded the problem, as did reliance on an external film-processing lab handling more than 70 rolls of film, whose one-week turnaround could not be guaranteed.

The inclusion of several guest sessions reduced the time available for hands-on camera construction and shooting—a trade-off students later identified in their reflections. Feedback and assessment were consequently delayed, and the resulting frustration, rather than being treated as simple failure, became diagnostic: it directed the re-planning that produced the tighter, single-guest-lecture structure adopted in Cycle 2. The intention was to use this hands-on process to develop technical literacy, visual awareness, and problem-solving through mushfaking, while also helping students understand that photographic meaning can emerge from material constraint rather than from expensive equipment.

It was essential to report on this first cycle, which did not unfold as planned. More often than not, research reports tend to emphasise the positive aspects of conducting a research project, while there are equally important lessons to be learned from phases of the research process that do not work out as anticipated. Reporting on such experiences is characteristic of action research, which foregrounds researchers' lived experiences. As Mabunda and McKay (2024) demonstrate in their work on early-career teachers, these lived experiences—whether positive or not-so-positive—can provide valuable insights and contribute to learning from the research process itself.

Cycle 2: Building the camera

In Cycle 2, informed by the first two weeks of the learning unit, students assembled their own image-making devices by repurposing readily available materials including camera body caps, duct tape, and aluminium soft-drink cans. But now students were working with 3D-printed pinhole cameras, building from their knowledge of the repurposed DSLR digital pinhole cameras. This cycle also demanded immediate tactile engagement with objects in their

immediate environment. The act of building the camera as a tool became inseparable from its understanding. By challenging students to negotiate the physical limitations of their DIY devices, the curriculum cultivated profound creativity. Students were not merely learning to capture images; they were learning to overcome systemic technological limitations through adaptive, collaborative design.

Unexpectedly, the assembly process revealed the extent to which Flusser's (2000) black box metaphor had become internalised as a psychological reality for students. When confronted with the requirement to pierce their own aperture into a piece of aluminium foil, many students initially expressed disbelief that such a rudimentary device could produce an image of any quality. This reaction is precisely the condition identified by Flusser as technological mystification: the uncritical assumption that only complex, commercially manufactured apparatuses can produce legitimate outcomes. Therefore, in dismantling the camera and rebuilding it from waste materials, students were doing more than acquiring a technical skill. They were enacting what Freire (1970) in his seminal work on liberating education, describes as the act of *naming the world*: the moment at which a learner stops accepting the conditions of their reality as natural and fixed and begins to perceive them as constructed, contingent, and therefore changeable. In essence, it is about coming to terms with complexity, as Vandeyar (2026) and colleagues interrogate across several fields of learning. The construct "field of learning" is used instead of "field of specialisation" because it better reflects the importance of a learning-centred pedagogy. The incomplete pinhole camera became a material argument against technological mystification. It demonstrated that the physics of light is not the exclusive property of expensive equipment, a principle that can be understood, manipulated, and creatively deployed by anyone willing to.

Cycle 3: Advancing through 3D design

In the third week of the initiative, the pedagogy was advanced by incorporating CAD and 3D printing. Students were provided with a modular 3D-printed pinhole camera and attachments to use with 35 mm black-and-white film. This cycle extended bricolage logic into the domain of digital fabrication, requiring students to develop spatial reasoning, iterative design thinking, and an understanding of how analogue optical principles are translated into digitally manufactured forms. The combination of hand-cut aluminium with 3D-printed components introduced new layers of technical problem-solving while retaining the core pedagogical principle of material constraint as a driver of epistemic agency.

The incorporation of 3D-printed pinhole cameras in the third cycle was not merely a technological upgrade. It represented a deliberate expansion of the multiliteracies being cultivated, adding to the tactile and optical literacies developed in Cycles 1 and 2—what Cope and Kalantzis (2009) would recognise as digital design literacy. In hindsight, we came to realise that the intention with Cycle 1 was to develop some of these literacies such as composition, framing, and understanding shutter speed. Apart from planning for these literacies to develop, the planning included guest lectures and in-class peer-review feedback on the images produced.

The New London Group (1996) first articulated multiliteracies as a pedagogy of social futures, insisting that literacy education must account for the multimodal and culturally diverse nature of contemporary communication. Kress and Van Leeuwen (1996) give this a visual grammar, demonstrating that producing and reading images involves structured semiotic competencies that are as learnable as verbal literacy—competencies that the 3D printing cycle required students to develop in tandem. Crucially, the collaborative character of the 3D printing process, in which students shared modelling files, troubleshot print failures collectively, and refined designs through peer consultation, is not merely a social by-product of the learning design. It is the form that Ubuntugogy takes in practice. Mthimkhulu's (2024) literature review on Ubuntugogy confirms that structured collective knowledge-making in African classrooms promotes communalism, collaboration, and the appreciation of African knowledge systems as curriculum values rather than as incidental classroom dynamics. The 3D printing cycle operationalised these values precisely; the prototype was never only the individual student's problem but a shared material argument for the group.

Students were now required to operate simultaneously across analogue physics, 3D-printed cameras as tactile artefacts made using digital modelling tools, and material fabrication processes—a genuinely multimodal set of demands that mirrors the complexity of professional practice in contemporary multimedia fields. Crucially, the iterative nature of 3D-printed design, in which a prototype is printed, tested, found wanting, and redesigned, reflects Steyn's (2019) ongoing "infinity" process between planning, making and testing, and structurally mirrors the reflective learning cycle that Mezirow (1991) identifies as essential to transformative learning. Students did not simply complete a task; they engaged in continuous critical evaluation. By the end of Cycle 3, the design camera had become inseparable from the student's own learning pathway, a fusion of making and knowing that the mushfaking framework is specifically designed to produce. These interpretations are grounded in the observed shifts in equipment-sharing behaviour, the documented improvisations in camera construction, and students' reflections on their changing relationship to "proper" technology.

Findings and discussion: Multiliteracy and Ubuntu

Baseline survey data (introduced in the methodology above) confirmed that the study cohort was overwhelmingly at the beginning of their photographic learning journeys: more than 80% described themselves as "newbie" photographers across both groups, fewer than 20% owned any camera, and over 90% relied primarily on camera phones. These patterns are not incidental. They constitute the empirical surface of what this study frames as a wicked problem (Rittel & Webber, 1973): a constrained teaching and learning environment in which the very technology assumed by the curriculum is structurally unavailable to the majority of students. Rittel and Webber's notion of a wicked problem within a constrained environment was recently revisited by Corbin et al. (2026), extrapolated to a focus on the wicked problem of AI and assessment.

Anxiety of the "proper" and the failure of the sharing model

A significant psychological barrier resulted immediately from the material shortfall reported in the baseline surveys. Students reported a profound anxiety that they were fundamentally

doomed to fail creatively if they did not have access to proper high-end proprietary equipment. Higher education institutions often offer a common pool of pricey departmental cameras as an apparently practical alternative. Qualitative findings, however, demonstrate the severe distress this approach causes. Students' everyday lives were fundamentally at odds with the booking systems. There was an immediate structural disadvantage because access was limited to small equipment windows. As one student articulated, "You find that you want to book out a camera, apparently they're all out. So you just have to wait." Some students resorted to paying their peers to rent equipment for assignments. The sharing model was also acutely vulnerable to load shedding. When power failed, departmental DSLRs became effectively useless for any student without a high-end personal laptop capable of running offline processing software.

However, it would be a mistake to understand this anxiety as a purely individual psychological response. Braidotti (2013) argues that conditions of structural scarcity generate what she terms reactive affects, habituated emotional orientations towards negativity and lack that are produced not by personal inadequacy but by the systemic organisation of access and exclusion. Ngubane and Makua (2021) arrive at a structurally identical conclusion from within scholarship of Ubuntu pedagogy, arguing that South African higher education's persistent reliance on Eurocentric pedagogical models produces orientations of inadequacy that are structural, not individual—what Ndlovu-Gatsheni (2018) terms epistemic violence. The student fear documented in this study, the conviction that one cannot produce legitimate photographic work without proper equipment, is, in these terms, the affective trace of a curriculum that has not yet been decolonised and is not responsive to the material and logistical constraints within which it can be implemented.

The fear students expressed about not having proper equipment was, in this light, a rational response to a curriculum that had been designed around an assumption of access that did not reflect their reality. Brenner and Theodore (2002) make a similar point at the macro scale, demonstrating how neoliberal urban restructuring produces geographically uneven landscapes in which participation in civic and economic life is conditional on the possession of resources that are structurally unavailable to many. Vygotsky (1978) offers a generative counterpoint: his Zone of Proximal Development suggests that what students cannot yet do independently becomes achievable through structured collaboration—a principle that the shared, constraint-driven camera assembly process enacts as material pedagogy rather than theoretical ideal. This analysis reveals that the booking system, the shared pool of cameras, and the recurrent power failures are not unfortunate logistical inconveniences when transposed to the higher education context. They are the material infrastructure of inequality reproduced, which is within institutions. Recognising this shifts the pedagogical task from managing individual student anxiety to redesigning the structural conditions that generate it. This study emphasises the need for a more drastic solution, viewing this issue as a wicked problem rather than a simple resource deficit. The digital pinhole and the 3D-printed camera initiative emerged as a way of reconfiguring the apparatus itself to improve access conditions.

These dynamics were vividly articulated in students' own accounts. One participant described feeling "fundamentally doomed to fail creatively" without access to a departmental digital

single lens reflex camera, while another explained that booking systems and load shedding made it almost impossible to complete assignments on time. One student remarked: "It's not being able to rent out the cameras on Thursdays and Fridays . . . when you go there already, they're like, oh, no, they're not available." Such testimonies reinforce Braidotti's reading of reactive affects as structurally generated, and Ngubane and Makua's (2021) argument that epistemic violence in South African higher education is experienced as habituated orientations of inadequacy rather than individual weakness. The subsequent cycles' foregrounding of mushfaking and bricolage must therefore be understood not as a romanticisation of scarcity but as a deliberate response to these student-identified constraints.

From passive consumers to bricoleurs: The sound of making

The curriculum changed students from being passive users of automated technology to active bricoleurs by having them physically assemble pinhole cameras in order to intentionally create limitations. However, the stripping away of automated digital interfaces forced a profound cognitive rupture, conceptualised within transformative learning theory as a *disorienting dilemma*. The most acute manifestation was the sudden realisation that students had no LCD screen to rely on for instant, perfectly exposed previews. This absence induced severe cognitive dissonance. Focus group transcripts reveal the depth of this anxiety, with students terrified of risking their academic marks on an analogue process that offered no immediate visual validation, frequently asking the facilitator, "What if it does not work?" Overcoming this dilemma required students to unlearn their reliance on digital instantaneity and manually calculate the physics of light, time, and optics, which fundamentally altered their relationship with the photographic medium.

Collaborative ingenuity and Ubuntu classrooms

The physical difficulty of assembling the camera renders solitary work nearly impossible. Because no single student possessed a structural advantage from expensive equipment, the anxiety of individual failure gave way to collective problem-solving. Students spontaneously formed collaborative working groups, subverting the highly individualised, competitive environment typical of neoliberalism in higher education (Brenner & Theodore, 2002). Guided by an Ubuntu-based mindset, students realised that collective survival was far more effective than individual advantage. As Letseka (2013) articulated, Ubuntu insists that human interconnectedness must supersede materialism. Yende (2024) builds on this, proposing Ubuntugogy as a formal pedagogical methodology for African higher education—one that structures collective knowledge-making into the curriculum rather than treating collaboration as an incidental classroom dynamic. Nicolaides and Steyn (2023) situate this within a broader argument for authentic African higher education grounded in African epistemology, challenging the assumption that individualistic, competitive academic models are culturally neutral. Ngubane and Makua (2021) provide the most direct empirical and theoretical framework for what this study observed: they argue that Ubuntu pedagogy, when properly enacted, is designed to respond to students' cultural competencies and to embrace the collective as the primary unit of learning. In the Ubuntu classroom, practices are structured so that

"students are motivated to help one another overcome learning barriers" and "become willing to learn together and share information" (Ngubane & Makua, 2021, p. 8). This is a precise description of what the camera building studio produced—not as an incidental social warmth but as the structural outcome of a curriculum designed to make solitary success impossible and collective ingenuity necessary. This philosophy was manifested visibly in the classroom given that knowledge sharing, 3D-printing files, and material ingenuity were valued above the individual ownership of a DSLR.

This collaborative dynamic found its most vivid expression in what classroom observations described as "tree mail," a solution that one group immediately circulated to assist others. A watershed example occurred when one student recognised the difficulty of bonding delicate aluminium foil to 3D-printed camera bodies using fast-setting superglue. The student substituted nail glue, a cosmetic adhesive, whose delayed curing time provided the necessary window to precisely reposition the pinhole before the bond was set. This single, highly localised improvisation exemplified mushfaking in its purest form. Governed by affirmative ethics, the chaotic classroom successfully incubated a mindset. As one student put it, "it stopped being my camera problem and became our design problem"—capturing the shift from competitive individualism to the collective ingenuity that Ubuntu pedagogy theorises, wherein students felt authorised to creatively reshape the curriculum.

What emerged in these collaborative spaces exceeded mere peer support. It constituted what Cope and Kalantzis (2009) would recognise as a living, situated multiliteracy practice: students were not learning about collaboration as an abstract competency but practising it as a material necessity, in real time, with real consequences for their academic outcomes. Knowledge moved through the classroom not as transmitted content but as a shared, embodied practice passed between groups through demonstration, physical guidance, and spontaneous verbal instruction. Letseka (2013) argues that the Ubuntu philosophy understands knowledge as inherently relational, insisting that what one person knows is always and already a resource for the community. This principle was not invoked rhetorically but enacted practically in the camera building studio. Students' willingness to share solutions, including assembly techniques and material workarounds, at no individual advantage to themselves represented a significant departure from the individualised assessment logic that typically governs higher education. This also suggests that the Ubuntu-informed classroom offers not only a culturally resonant framework for African higher education but also a genuinely alternative model of learning organisation, in which collective ingenuity is structurally valued rather than incidentally permitted. Bekele et al. (2023, p. 1528) extend this argument specifically into the domain of technology-enhanced learning, proposing that Ubuntu philosophy provides the conceptual architecture for pedagogies that are "liberating, emancipatory and empowering" in African higher education technology contexts—not as an alternative to technical competency but as the relational condition under which technical competency is most equitably developed. This is precisely the claim that the two DBAR cycles evidence: the Ubuntu classroom did not produce technically weaker students because it deprioritised individual performance; it produced technically more confident and adaptable students because collective ingenuity removed the structural disadvantage of unequal equipment access.

Disorienting dilemmas and emerging multiliteracies

The shift from automated digital cameras to pinhole and 3D-printed devices was designed to deliberately induce what Mezirow (1991) terms a disorienting dilemma. Students who had grown accustomed to immediate LCD feedback and auto-exposure were suddenly confronted with cameras that offered no preview, no autofocus, and no automatic metering. In the focus group reflections, the students recalled their initial reactions as panic. The panic arose from the idea that they would be assessed based on images produced with such primitive tools. They repeatedly asked: "What if it does not work?" This cognitive rupture closely aligns with Kong's (2015) observations on analogue photographic practices. Kong argues that the deliberate removal of digital instantaneity imposes tactility, tangibility, and sacrifice on the image-making process. For the current generation of born-digital students, this material strangeness is precisely what forces a critical re-engagement with the medium's fundamental physics and language.

Working through the discomfort of having to reassemble the camera required students to engage with exposure times, focal distance, and aperture physics in a far more intentional way than before. Rather than outsourcing calculations to the camera, they had to estimate the exposure, test, wait, and interpret the imperfect results as feedback rather than failure. Over time, this iterative process cultivated what the broader study termed multiliteracies (Cope & Kalantzis, 2009). These include technical and language literacy regarding aperture and shutter speed, critical literacy questioning what counts as a correctly exposed image, and reflective literacy using failed images as data for refining the next attempt. Thus, the disorienting dilemma became a catalyst, moving students from dependency on black-box automation towards a genuinely agentic and experimental relationship with photographic tools.

Beyond acquiring specific literacies, the iterative process of building, failing, and rebuilding produced a discernible shift in how students understood themselves in relation to their discipline. Mezirow (1991) argues that transformative learning does not merely add new knowledge to an existing worldview; it restructures the frame of reference through which a student understands their own capacity to act. By the end of the two DBAR cycles, focus-group reflections indicated that students were no longer describing themselves primarily in terms of what they lacked, specifically professional cameras and studio access, but in terms of what they had learned to do without them. Newbury (1997) provides the most precise disciplinary anchor for this identity claim. Through ethnographic research with photography students, Newbury demonstrates that professional identity in photography is not transmitted through equipment access but actively negotiated through sustained engagement with photographic culture and practice through the doing, the failing, and the remaking that the two DBAR cycles demanded. The students in this study who emerged able to describe themselves in terms of what they had learned to do rather than what they had been denied were enacting, in direct empirical form, the identity formation that Newbury's research predicted was possible. This is not a coincidental alignment; it suggests that the mushfaking curriculum produced, as a structural outcome, the kind of practitioner identity that photography education has long recognised as its goal but rarely produced in resource-constrained contexts. Schön's (1983) reflective

practitioner returns here as well. The students who emerged from the two DBAR cycles were not merely technically competent; they had begun to develop the capacity for reflective practice in action that defines professional expertise. This reorientation from deficit identity to resourceful practitioner identity is precisely what Braidotti (2013) means by the affirmative ethical subject: a self-constituted not by the negation of limitation but by the creative production of alternatives within it. The mushfaking pedagogy had, in effect, highlighted the potential to produce an adaptive practitioner identity, a graduate attribute oriented towards problem-solving under constraint rather than being paralysed by it. In a labour market increasingly defined by volatility and resource unpredictability, this identity formation may ultimately prove to be the most transferable outcome of this initiative.

Conclusion: Forward pathways for sustainable higher education

This research demonstrates that resource scarcity in higher education does not necessarily result in pedagogical despair. By formalising mushfaking as a metapedagogical tool, educators can forge actionable pathways. The digital pinhole and 3D-printed pinhole camera initiative is to prove that deliberately constrained, action-based curricula can cultivate creativity, critical improvisation, and affirmative ethics. These are precisely the capacities required to navigate the polycrisis of contemporary higher education.

This study offers an empirically tested blueprint for sustainable curriculum design in a metamodern era defined by oscillation between planetary anxiety and the demand for pragmatic, hopeful action (Vermeulen & Van den Akker, 2010). To accomplish this, one must excavate beyond the obvious and seemingly fixed boundaries of photographic technology and abandon received definitions of what counts as a screen, a camera, or a legitimate pedagogical tool. Rather than claiming to resolve the structural inequities of photographic education, the mushfaking framework offers an empirically grounded blueprint for reconfiguring the apparatus of learning so that students, regardless of socioeconomic position, can participate more equitably in resource-constrained classrooms. Its wider uptake would require institutional investment and further iterative cycles across disciplines and universities, but the present study demonstrates that such transformation is both conceptually and practically feasible at the unit level. The curriculum is Africanised not merely through geographical content but through a lived methodology, embedding the principles of Ubuntu and collaborative ingenuity into the core of the learning experience.

The alignment with SDG 4 and SDG 10 is more than a post-study framing and alignment. This reflects a structural argument about how equity is produced in higher education contexts. Ndlovu-Gatsheni (2022) insists that decolonial transformation in African higher education cannot be achieved through rhetorical gestures towards inclusivity while curriculum material and epistemological infrastructure remain organised according to imported resource-intensive assumptions. Agbaje (2023) reinforces this from a curriculum reform perspective, arguing that higher education in Africa must be reoriented towards solving societal problems; a mandate that the mushfaking framework operationalises through material practice rather than policy

rhetoric. The mushfaking framework operationalises this insistence: it does not merely advocate for equity but reconfigures the learning environment so that students, regardless of their socioeconomic position, can participate. In doing so, it offers a policy-relevant model for institutions seeking to honour their SDG commitments in practice, rather than in mission statements alone. Vermeulen and Van den Akker (2010) argue that the metamodern moment demands precisely this kind of oscillation between the ideal and pragmatic: a refusal to abandon the aspiration towards justice while remaining rigorously attentive to the material conditions in which that aspiration must be pursued. The mushfaking curriculum lives in constant change.

The developed DBAR model carried out in this study has direct transferability beyond photography education. Any curriculum domain characterised by wicked problems, such as design, engineering, nursing, or teacher education, can adapt the two-cycle logic of constraint-based intervention, followed by iterative, student-led refinement. Oksiutycz and Azionya (2017) document a comparable curriculum development action research process in a South African higher education context, confirming measurable improvements in student learning experience through iterative, practitioner-led redesign. Cross et al. (2021) provide the broader theoretical architecture, demonstrating that transformative curricula and epistemologies are not context-specific innovations but scalable frameworks for diverse African higher education contexts. However, transferability requires honesty about conditions. Stuart and Kunje (1998, p. 391), in their study of action research in resource-constrained African education systems, found that successful replication demands "much support from facilitators, particularly where basic resources, professional background training and critical approach are lacking." The present study was conducted with a committed researcher-facilitator who was simultaneously embedded in the same infrastructural constraints as the students. Replicating its outcomes in other disciplinary or institutional contexts will require not only methodological adaptation but institutional investment in the kind of practitioner-led, co-intentional curriculum design that the DBAR model demands. This core principle holds across disciplines. When the apparatus of learning is handed back to the student, the act of assembly and the act of knowing become inseparable. Curriculum designers, faculty developers, and institutional policymakers are invited to consider how productively accommodating pedagogies might be embedded, not as exceptional responses to scarcity, but as the foundational orientation of sustainable higher education in the Global South and beyond.

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