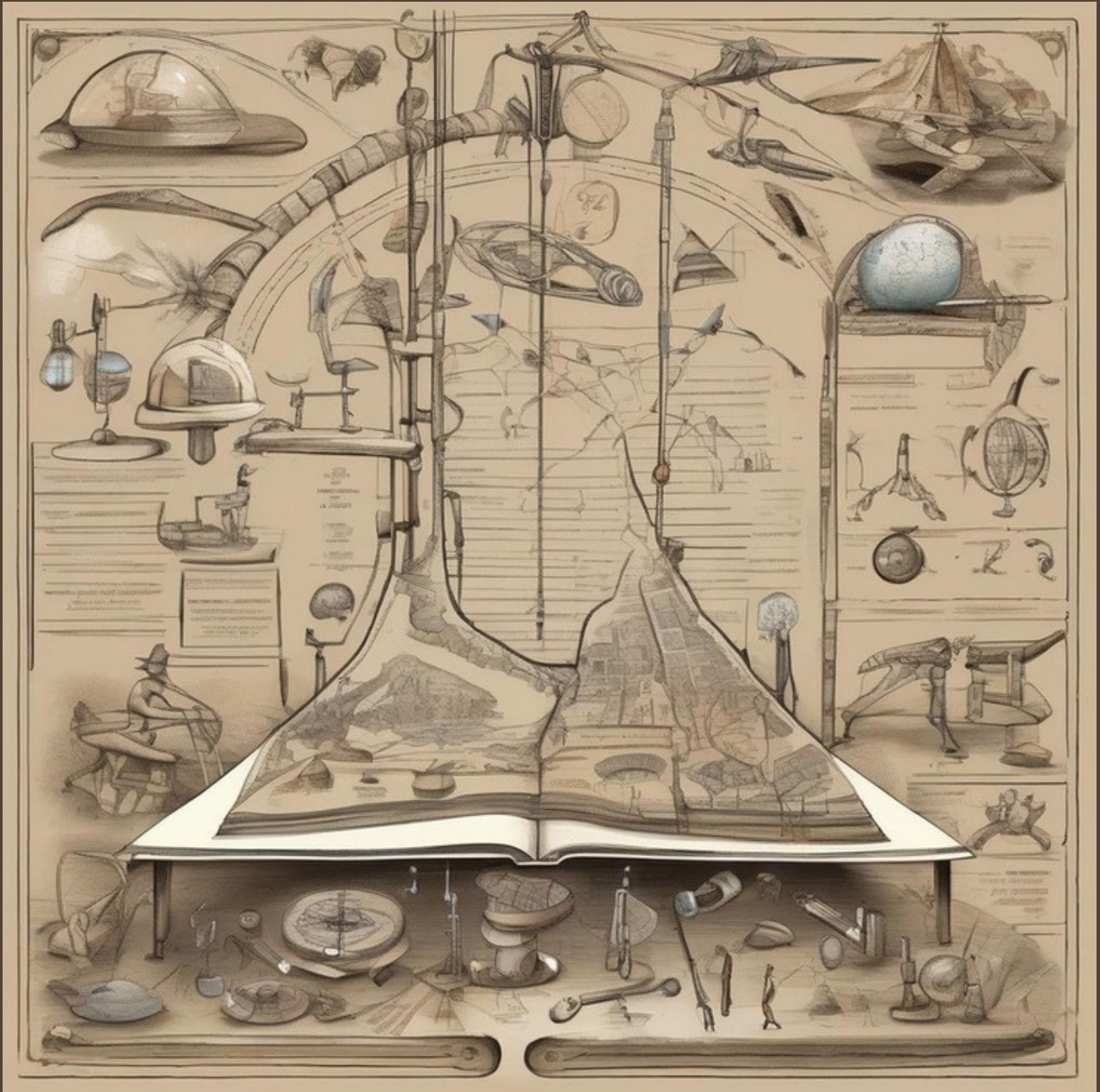


THE OPEN REVIEW

Journal of the South West Doctoral Training Partnership



10TH ANNIVERSARY EDITION

Past, Present, Future

JUNE 2025

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LETTER FROM THE EDITORS

We are honoured to present the 10th anniversary edition of The Open Review (TOR), marking a decade of curiosity, reflection, and rigorous scholarship. In keeping with the significance of this milestone, our chosen theme — Past, Present, Future — invites contributors and readers alike to traverse time: to revisit what came before, critically engage with the now, and imagine what lies ahead.

Reflecting on the journey of TOR itself, we are reminded that every volume has been built upon the legacy of those who came before it — nurturing voices, encouraging dialogue, and creating space for postgraduate researchers to engage in thoughtful exchange. This 10th anniversary edition stands as both a celebration and continuation of that ethos, made possible by the enthusiasm of our contributors, the diligence of our peer reviewers, and the collaborative spirit of the editorial committee.

This year's submissions span a wide array of disciplines and approaches but are united by their engagement with time. From historical analysis and retrospective studies to commentary on today's social challenges and explorations of what may shape our collective future, this edition exemplifies the dynamism and depth of contemporary social science research. It showcases how the past continues to inform the present and how our present reflections can illuminate pathways forward.

“OUR CHOSEN THEME — PAST, PRESENT, FUTURE — INVITES CONTRIBUTORS AND READERS ALIKE TO TRAVERSE TIME: TO REVISIT WHAT CAME BEFORE, CRITICALLY ENGAGE WITH THE NOW, AND IMAGINE WHAT LIES AHEAD.”

Editing this anniversary edition has not only been an academic task but a reflective exercise. It reminded us that journals like TOR are living documents — anchored in scholarly tradition yet constantly evolving with each cohort of thinkers and themes. We hope this edition captures the richness of this year's contributions and prompts readers to consider their position within these temporal currents.

We invite you to join us on this journey through time — to read, to reflect, and, as always, to question.

The TOR Editorial Committee

LETTER FROM DR BENJAMIN BOWMAN

Ten years ago, I came up with the idea of 'The Open Review' (TOR) at a meeting of the Academic Advisory Board (AAB) of what was then the South West Doctoral Training Centre (SWDTC)– now, the South West Doctoral Training Partnership (SWDTP). As postgraduate researchers, we felt ourselves standing on uncertain ground, at a time when the proportion of UK academics who were employed on temporary contracts had reached over 34% according to HESA figures at the time (2017) or closer to 54% according to the University and College Union (2016). We had all heard the phrase “publish or perish” which tolled in our working lives like a bell, in training sessions, in meetings with senior academics, and in various other contexts where academia, as a field of endeavour, asked us to accept that some of us would perish. We felt, as Emma Vossen wrote, that “academic publishing is broken and most of us can’t afford to fix it” (2017, 121), but also that something could be done to address the structures of academic publishing. As Vik Loveday writes, stories of academic success like finding a solid job, getting a first publication and capturing a first research grant are most commonly narrated by early career academics as a lucky break, reflecting “the tenuous position in which a sizeable proportion of the academic workforce now find themselves” (2017, 762). We refused to be comfortable with the principle that some of our PhD colleagues would publish and others should perish, and we wanted to shore up a safe harbour amid uncertainty, even if the haven we built was small, against the tide of precarity and competition in our working lives.

“FROM THE START, WE ENVISIONED A PEER REVIEWED JOURNAL THAT WOULD INVOLVE POSTGRADUATES IN THE PROCESS OF PEER REVIEW, OFFERING THAT EXPERIENCE AND KNOWLEDGE TO OUR PEERS, BUT ALSO A SUPPORTIVE STRUCTURE FOR THOSE WHO OTHERWISE MIGHT NOT HAVE THE CONNECTIONS OR CAPITAL TO GET THAT FIRST CHANCE AT SERVING AS PEER REVIEWER.”

Our AAB meetings were held at 1 Priory Road in Bristol, a University building that was separate from our home Departments and as a team involving SWDTP staff and student representatives around the same table. Our meetings were important to us, as were the annual postgraduate-led SWDTP conferences, which were themselves an attempt to build supportive, collaborative and student-led spaces for postgraduates to work together. We felt that spaces like the AAB and the SWDTP postgraduate conference were coming together as a refuge in uncertain times, when...

“... the corridors, offices, and doorways of the university present complicated and fraught terrain for precarious scholars. These spaces exist as sites of promise and optimism – offering the hope of a career in academia where the training provided by our doctoral research comes to fruition – but also of potential failure, where competition, cruelty, and betrayal are customary, and resources are scarce” (Burton and Bowman 2022, 502-503).

The journal was our next step for our postgraduate community. We saw, at the conference, moments of solidarity, collaboration and kindness flourishing where postgraduates could work together and collaborate. We supported each other in a team, some of whom ended up editors of the Journal proper: Benjamin Bowman, Katherine Evans, Frederick Harry Pitts, Ioannis Costas Batlle, Gwilym Owen, Jessica Roy, Ed Atkins. We were part of a wider community of PhD scholars, early career researchers and comrades across the SWDTP institutions. We had so much support from others that I can't name everyone, but I write in gratitude to all our colleagues and friends who supported us and the journal in those early days. We relied on the SWDTP team, including Molly Conisbee who supported us with a sense of courage and adventure; the clarity and dedication of Joanna Williams; the kind leadership of Sonja Foster; and the support of then Director, Sally Barnes. Our collaboration (and a modest budget from the SWDTP) was the foundation for the safe harbour we hoped to build, and we are still grateful for the support of others as we took our own first steps in publishing.

We had so many academics as allies across the institutions of the SWDTP that we could never name them all, but among them were our peer review trainers: Sue Timmis, Rajiv Sarin, Susan Milner and Susan Kelly. We felt among ourselves, and we heard from our postgraduate colleagues, that one structural barrier to getting that first publication was not knowing how peer review worked. From the start, we envisioned a peer reviewed journal that would involve postgraduates in the process of peer review, offering that experience and knowledge to our peers, but also a supportive structure for those who otherwise might not have the connections or capital to get that first chance at serving as peer reviewer.

If you had been a PhD candidate in the SWDTP back in 2014, and you had emailed our editorial board for advice about publishing, this was the email you would have received from me:

Good to hear from you. The journal is intended to be an open, peer-reviewed publication for the social sciences by students and for students. We (being the editorial board of fellow students) have secured funding and publication rights and are now planning the first issue.

It seemed like a gap in the institution that we're all supposed to be published but there wasn't an institutional framework for publication, so the idea was to run an open, student-led, and respectable journal and support student publications that way. Our scope is the social sciences as defined by the SWDTC.

If you're looking to publish an article that is exactly what we're here for. We are also planning to run peer review training courses and so on, so to answer your question your contribution would be very welcome and I hope the journal can serve your needs, too.

Will you be at the conference on Wednesday? If so we will have a table there, you could come over and say hello?

I am over the moon that TOR continues to offer a space that welcomes early career academics and serves their needs. I am thankful to be invited to celebrate TOR's tenth anniversary, and to share in the flourishing of early career academics who respond to

precarity by trying to thrive together, with a "focus on community, sharing, and intellectual joyfulness" (Burton and Bowman 2022, 509) rather than competition. Our vision for this journal was to celebrate a space that rose up amid the landscape of our wider academic work, like the Glastonbury Tor that inspires its logo, and offers a place to meet together and stand together with others.

"I AM OVER THE MOON THAT TOR CONTINUES TO OFFER A SPACE THAT WELCOMES EARLY CAREER ACADEMICS AND SERVES THEIR NEEDS."

It is a great honour to have provided that space for others and to have facilitated a decade of scholarship in the South West. I hope that everyone who is part of this journal's community of writers, readers, editors, reviewers and supporters will share our celebration of solidarity amid precarity, and refusal to accept concepts like "publish or perish". I am grateful to everyone who has supported us, and to everyone who has, once they climbed the academic ranks, turned back to pull us up behind them. To every academic who supports others, cooperates when their workplace would have them compete, and pays favours along, I wish strength and courage. Thank you all.

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THE EVOLUTION OF DIABETES EDUCATION: PAST, PRESENT, FUTURE

Amy Herbert, University of Bath

Abstract

Type 2 diabetes (T2DM) is a chronic metabolic disorder affecting 3.8 million adults in the UK and this figure is rising (Diabetes UK, 2023). Diabetes self-management education (DSME) is an evidenced-based service model designed to help people with type 2 diabetes self-manage their condition. It offers education on nutrition, physical activity, medication, etc. to improve health outcomes by reducing diabetes complications. Diabetes treatment costs the NHS almost £10 billion a year which is 10% of its entire budget (NHS England, 2022), highlighting a significant public health challenge. Given that patient uptake of DSME has been low for over thirty years despite its evidenced benefits suggests the need to cast a wide lens on the situation.

This poem, composed in rhyming couplets, explores the transformation in diabetes education over the past century. From fear-based instruction to the more empowering, patient-centred approaches of today. Themes woven throughout the stanzas highlight how diabetes education has been shaped by research, changing treatment models, and its intersection with societal stigma. I reflect on the practical and emotional challenges experienced by people with type 2 diabetes in this ever-changing landscape and how these relate to low uptake of DSME. Diabetes stigma remains prevalent and medical literature often fails to humanise the diabetes experience. As such, this poem offers a lyrical exploration of the diabetes journey to educate and to inspire compassion. The concluding stanza looks towards the future and offers direction to mitigate the challenging trajectory of widening health inequalities.

Acronyms

Diabetes self-management education (DSME)

Poem

Diabetes is rising
At a rate that's surprising
You could say it's unacceptable
Since type 2 is preventable

Now Diabetes UK
Do regrettably say
It has reached the millions
Costing the NHS billions
But before we respond with fear
Why don't we ask
How did we get here?

In the nineteen hundreds
Far back in the past
Diabetes would kill you fast
Treatment was a starvation diet
Until diabetes went deadly quiet

Then insulin offered hope
Finally, a new way to cope
Insulin administration
Was prime diabetic education
But longevity led to complication

Education became so rule-based
Disapproval, is what patients faced
If they struggled to lose weight
This stigma let loose significant hate

The nineteen nineties saw a shift
Pessimism began to lift
As each diabetes' facet
Became explicitly tacit
Instead of following diabetes drills
Patients were taught problem-solving skills

Tailoring of patient goals
Helped them to feel more involved
In the decisions based on their care
It became the norm almost everywhere

Now, we must recollect
That society can deflect
Its stake and its responsibility
In helping patients live healthily
Our obesogenic society
Is a collective liability
This gradual recognition was key
In paving the way for DSME

DSME's intention
Is a form of prevention
In courses, activities, and even apps
A personalised way of helping adapt
Affecting quality of life
Navigating strife
Even teaching technology
To adjust the patients' biology

DSME utility
Is evidenced, unequivocally
In a way that purports
That self-management support
will lower your blood glucose
And stop you going comatose

Yet, despite the evidence base
Uptake is a disgrace
This was reported 30 years ago
So why is attendance still so low?

The educations' perceived utility
Is very poor in this vicinity
Combined with scant knowledge of DSME
And their ability to manage autonomously
Many patients effectively say
That DSME is not for me

But the authors on this topic say
Stigma keeps the patients away
Being lectured to lose weight
Is something that they come to hate
It's a prospect to revile
And may very well lead to denial

They tell themselves it's a mild disease
To protect themselves from much unease
DSME could lead to regret
To a way of coping that's under threat

It's no surprise
We need to surmise
That DSME isn't marketed right
And patients need something more
Something that isn't considered a chore
As Polonsky in 21 reports
DSME just might be a bore
Telling them things they know and abhor

The double-edged sword
DSME needs them to afford
Healthy snacks and safe outdoor spaces
Something which gets thrown in their faces
Also health literacy and time to care
For those with multiple jobs to bare

I'm about to finish my case
That uptake is a disgrace
We need to further close the gap
By removing the trap
That excludes millions on the map.

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GLOBAL TRENDS AND PRIORITIES IN STEM TEACHING AND LEARNING: A LITERATURE REVIEW

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Abstract

The world continues to prioritise STEM (science, technology, engineering, and math) education because it develops higher-order thinking abilities which prepare learners to handle the complexities of our fast-evolving world. International government policies have steadily supported the advancement of STEM education during the past decades because they recognise its ability to prepare students with essential adaptability and resilience skills for future employment opportunities. However, true interdisciplinary integration within STEM education remains a major challenge to achieve.

Despite both broad policy support and international focus, educational outcomes remain affected by continuing problems with STEM integration. STEM education stands as fundamental to workforce preparation because it develops critical thinking and problem-solving skills through flexible learning approaches, yet numerous educational systems face challenges when trying to provide cohesive interdisciplinary STEM instruction.

To address these existing challenges, research indicates that advancing STEM education requires both innovative pedagogic approaches, inclusion and strong leadership. However, important questions remain: How do existing studies illuminate the relationship between leadership and the successful implementation of innovative strategies in STEM integration? How can this relationship be leveraged to improve educational outcomes in STEM? Furthermore, what specific roles do these pedagogic innovations currently play in overcoming challenges in STEM pedagogy, and in what ways can effective leadership amplify their impact progressively?

Keywords: STEM Education, Policy Development, STEM Integration, Pedagogy, Educational Leadership, Workforce Readiness, Innovation

Introduction

Science, technology, engineering, and mathematics (STEM) fields have become prominent subjects due to their essential contributions to economic advancement and technological innovation (Xie, Fang, and Shauman, 2015; Bybee, 2010). As the world economy becomes more and more reliant on scientific and technical developments, it is critical to comprehend how STEM education evolves to meet these demands (Kennedy and Odell, 2014; National Research Council, 2011; Marginson et al., 2013). This paper presents a comprehensive review of literature that traces how global STEM teaching and learning trends have evolved from traditional practices to current innovations and into future possibilities.

Scoping Review Methodology

The purpose of this scoping review was to explore the current literature on “Global Trends and Priorities in STEM Teaching and Learning: a literature review,” and determine key themes while identifying existing trends and research gaps. The review operated based on the framework developed by both Arksey and O'Malley (2005) along with Peters et al.'s (2020) framework, which provides an effective approach for examining wide-ranging subjects and integrating multiple sources. Searches in Scopus, Web of Science, and Google Scholar identified peer-reviewed journal articles along with books and conference papers. The search process employed keywords such as "STEM education", "STEM pedagogy", "educational leadership", "workforce readiness", "innovation", "sociocultural theory", "dialogic teaching", and "21st-century skills". The research focused on works from the past fifteen years but incorporated foundational studies like Vygotsky (1978) due to their theoretical importance. The articles underwent thematic analysis to discover main controversies, theoretical advancements and unexplored areas in existing literature. The methodology establishes a full understanding of the field and identifies potential directions for future research.

Key Trends Shaping STEM Education Worldwide

The latest developments in STEM education respond to the increasing need for workers who possess flexible problem-solving abilities to navigate through workforce changes. Educational institutions, along with governments across the globe, are enhancing STEM curricula through the inclusion of real-world applications while developing critical thinking skills and digital literacy capabilities (World Economic Forum, 2023). The STEM Coalition of the European Union set up educational guidelines for teaching computational thinking and coding to young learners to prepare them for future challenges (European Commission, 2023). Similarly, initiatives like the U.S. STEM Education Strategic Plan identifies equitable access to quality STEM education as its highest priority while emphasising support for under-represented groups (National Science Foundation, 2023).

The trajectory of STEM education will be defined by the development of artificial intelligence and biotechnology technologies. Research predicts education will shift toward personalised student learning through AI platforms that create custom teaching strategies based on individual student needs (Brown et al., 2024). Experts forecast growing interdisciplinary collaboration between STEM fields and social sciences and humanities to address complex global issues like climate change and cybersecurity (OECD, 2024; Luckin, 2022). Schleicher (2023) suggests that the ongoing changes require ongoing funding for educational staff development along with curriculum improvements to keep STEM education as a driving force for sustainable global advancement.

Several transformative trends are currently establishing the direction for STEM education across the world. A significant educational development involves using technology in classroom settings to improve teaching methods and increase student involvement (Li et al., 2020). Virtual reality (VR), artificial intelligence (AI), and online learning platforms enable educators to create learning experiences that are both interactive and customised for students (Dede, 2019; Luckin et al., 2016). Research by Johnson et al. (2021) demonstrates that AI-enabled platforms detect student learning gaps and deliver customised interventions which lead to better educational results. South Korea and Singapore in East Asia extensively incorporate AI and VR technologies in their educational systems to remain competitive in global education rankings, according to Lee et al. (2023). Regions like Sub-Saharan Africa are utilising cost-effective mobile learning solutions to overcome infrastructure problems while expanding STEM education access, according to UNESCO (2022).

The educational sector is increasingly adopting interdisciplinary methods as a major development trend. Combining science with technology and merging engineering with mathematics enables students to work together while developing the skills needed to solve intricate problems they encounter in the real world (Bybee, 2013; Vasquez, Sneider and Comer, 2013). The United States' Next Generation Science Standards (NGSS) focus on interdisciplinary skills and practical applications that support worldwide STEM education transformation efforts (National Research Council, 2012). European countries, including Finland, are developing their national curricula with interdisciplinary frameworks that merge STEM subjects with arts and humanities to advance creativity and innovation (OECD, 2023). Latin America has developed STEM+C programmes which merge computational thinking with conventional STEM subjects to solve local issues such as climate change and sustainable development (Garcia & Martinez, 2023).

Inclusivity and accessibility are also gaining prominence. UNESCO (2020) determined that STEM education inclusivity is vital to allow women and minorities to participate actively while contributing diverse perspectives to scientific advancement. Access gaps can be reduced through the combination of targeted scholarships and mentorship programmes along with community outreach efforts. The "Girls in STEM" programme in India is making strides toward reducing the gender gap in STEM fields through mentoring female students and providing necessary resources (Kumar, 2022). Australian STEM outreach programmes

combine Indigenous traditional knowledge with contemporary scientific methods to support Indigenous communities through culturally relevant inclusive education (Smith and Brown, 2023).

The focus on sustainable practices and global issues is reshaping STEM education internationally. Educational programmes have adopted the United Nations' Sustainable Development Goals (SDGs) to educate students about pressing topics such as climate change, renewable energy sources, and public health issues (UNESCO, 2021). Industrial partners work with North American universities to incorporate research on sustainability into STEM programmes (Greenfield, 2023). Similarly, European academic institutions integrate sustainability-focused innovations into educational content so that students gain necessary abilities to confront environmental and social problems (Leal Filho et al., 2019). African STEM programmes combat food security challenges by using innovative agricultural methods, including precision farming technologies and bioengineering applications (Okafor et al., 2023).

Theoretical Frameworks and Pedagogical Concepts in STEM Education

The development of STEM education depends on multiple theoretical frameworks and teaching principles that remain influential in determining its unique teaching approaches – integration. The term "STEM" usually refers to an integrated approach to teaching and learning when it comes to education and curriculum (Zendler et al., 2018; Kelley and Knowles, 2016; Bybee, 2010).

One of the well-acclaimed British theorist-educationalists who historically discussed the concept of an integrated curriculum and whose work has been applied in STEM is Basil Bernstein. Pluim et al. (2021, p. 717) acknowledge that "Bernstein's work helps us interpret the analysis of the trends in curriculum integration and suggests how this might liberate the packaging of knowledge with and for students." Bernstein's theory of pedagogic discourse (2000) serves as an essential framework to analyse the classification and framing of knowledge transmission in STEM curricula. The framework illustrates how specialised knowledge must be transformed to bridge its gap with everyday knowledge so that it becomes accessible and usable. Critics say that this theory fails to explore digital transformation in education, which now plays a central role in STEM pedagogical strategies (Young, 2019).

The sociocultural framework introduced by Vygotsky in 1978 remains pertinent to STEM educational environments where collaboration and technology use social interaction and cultural tools as core components. The research conducted by Mercer et al. (2019) developed this theory to highlight dialogic teaching—a technique that promotes learning through continuous teacher-student and student-student interactions that enhance critical thinking and problem-solving abilities within STEM classroom settings. This method enables

students to express, debate, and hone their ideas in controlled conversations, which promotes critical thinking and problem-solving skills. Although sociocultural theory champions interactive learning benefits, it receives criticism because it overlooks structural barriers that prevent equal educational access. Structural barriers, such as limited funding, inadequate teacher training, and disparities in digital infrastructure (Selwyn, 2022), can prevent students in under-resourced settings from benefiting fully from dialogic teaching and STEM-related technologies.

The mathematical modelling framework established by Leung (2008) provides essential connections between theoretical STEM ideas and practical applications, which serves as a vital foundation for developing educational programmes tackling global issues like climate change and sustainable development (OECD, 2023). The actualisation of such frameworks meets opposition from strict assessment systems that favour memorisation skills instead of practical abilities (Zhao, 2020).

The Communities of Practice framework developed by Wenger in 1998 stands as a critical tool for promoting collaborative learning and knowledge sharing among students studying STEM subjects. New implementations demonstrate how the framework helps learners build knowledge together in investigative learning spaces (Wenger, 1998; Lave and Wenger, 2021). In-depth exploration of this framework's application in virtual or hybrid learning environments has yet to occur, especially concerning students who encounter difficulties from inadequate digital infrastructure access. According to critics, the framework risks marginalising learners who face difficulties integrating into these communities because of language barriers, cultural differences, or insufficient digital literacy skills (Bali, 2021).

These frameworks together shape modern STEM teaching methods by focusing on inquiry-based learning and collaboration while ensuring contextual relevance. Successful implementation of these frameworks depends on constant critical reflection to tackle systemic inequities while adapting to new technologies and responding to global challenges that continue to change.

The Global STEM Historic Narrative

Every nation in the world has a unique political, social, and technological past; hence, the educational systems that have developed—particularly those pertaining to technology education—are likewise unique and reflect these historical influences (Williams, 2011). When it comes to the STEM narrative globally, as revealed by the literature, four geo-social domains that are distinguished by distinctly varied approaches to STEM are (1) English-speaking nations; (2) Western European nations; (3) Asian nations; and (4) developing/emerging nations.

According to Blackwell and Howell (2015), in the US, the political reactionary discourse

around STEM is rooted in fears of the US losing its place as the world's preeminent nation. The US claims that emphasising STEM will lead to:

reaffirming and strengthening America's role as the world's engine of scientific discovery and technological innovation, which is essential to meeting the challenges of this century. That's why I am committed to making the improvement of STEM education over the next decade a national priority. (Obama, 2009)

Comparable but different from one another is that the concept of human capital informs the UK's commitment to STEM as echoed by Sainsbury (2007, p. 3):

The best way for the UK to compete in an era of globalisation is to move into high-value goods, services and industries. An effective science and innovation system is vital to achieve this objective... A major campaign to improve science, technology, engineering and mathematics (STEM) teaching in schools is needed.

Some literature also attests that as the need to strengthen its capacity for innovation and enterprise grows more pressing, the UK attempts to position itself against competitors around the world in an era of rapid economic change, as a result, promoting and coordinating STEM initiatives at the national level is one way to accomplish this goal (Wong et al., 2016; Blackley and Howell, 2015). The main objectives of the Western-orientated STEM agenda, as supported by governments and advanced by politicians (Blackwell and Howell, 2015), have been economic and vocational (Williams, 2011). Its significance was defended by a number of economic arguments, and changes in the composition of the workforce or periods of economic recession have been linked to a greater emphasis on STEM (Williams, 2011; Kuenzi, 2008). It is interesting to note that, aside from Canada, the prevailing "STEM crisis" is most prevalent in English-speaking nations (Blackwell and Howell, 2015) and is founded on:

"quantitative indicators that show a declining relative (or even absolute) performance in international comparisons of achievement and a lower rank than the nation believes it should occupy; and/ or declines in participation in STEM subjects at school" (Marginson et al., 2013, p. 55).

Some Western European nations, including France and Germany, as Marginson et al. (2013) opined, have long prioritized STEM in their national education and industrial policies; in these nations, the emphasis has been on the apparent "shortage" of STEM rather than the "crisis." The typical objectives of these policies and strategies are the promotion of a positive image of science, raising public awareness of science, enhancing science education in schools, and boosting interest in and participation in STEM fields at the postsecondary level and the STEM workforce (Marginson et al., 2013). See table 1.

	Mathematics literacy performance (score)	Science literacy performance (score)
OECD average	472	485
US	465	499
UK	489	500
Australia	487	507
France	474	487
Germany	475	492

Table 1: 2022 PISA results for key English-speaking and Western European countries (OECD, 2023).

*The Organisation for Economic Co-operation and Development (OECD) administers the Programme for International Student Assessment (PISA) to evaluate 15-year-old students' abilities in mathematics, science and reading. The outcomes from the PISA assessments have played a major role in forming worldwide education strategies while revealing gaps in STEM education.

Asian countries, including countries like Korea, Japan, China, Singapore and Taiwan that have growing economies, very high-performing education systems, and national policies centred around science and technology, as well as research and development that is driven by both industry and universities (Blackley and Howell, 2015). Moreover, meritocratic career systems that honour excellence in teaching these subjects are present in high-performing STEM nations in Asia (Marginson et al., 2013). PISA 2022's scientific literacy was topped by Singapore and seconded by Japan, while the mathematics components was won by Singapore and seconded by Macao (China). Significantly, the first top five countries in the most current PISA 2022 science and mathematics literacy performance were Asian nations – Singapore, Japan, Macao, Chinese Taipei, Korea and Hong Kong (see Table 2 and Table 3 below). Blackley and Howell (2015) report that long-term planning strategies are used throughout these nations, and the government and the general public both deeply and widely agree on the value of STEM and its connections to research and development. In these Asian nations, the discourse surrounding STEM is more stable and terminology less ambiguous; no "crisis" is identified, little change is noted, and there are few problems with teaching capacity (Blackley and Howell, 2015). The strategies used by these nations to achieve their STEM superiority become vital; these include comprehensive improvement initiatives in STEM curriculum and pedagogy implemented in all school systems, policies

centred on attainable quantitative benchmarks, a shared shift toward student-centred, problem-solving and inquiry-based learning, and a strong emphasis on creativity and critical thinking (Cheng, 2022; Marginson et al., 2013).

		Science score 2022	Science score change from 2018			Science score 2022	Science score change from 2018
Above the OECD average	Singapore	561	10	Below the OECD average	Iceland	447	-28
	Japan	547	17		Brunei Darussalam	446	15
	<i>Macao (China)</i>	543	0		Chile	444	0
	<i>Chinese Taipei</i>	537	22		Greece	441	-11
	Korea	528	9		Uruguay	435	10
	Estonia	526	-4		Qatar	432	13
	<i>Hong Kong (China)*</i>	520	4		United Arab Emirates	432	-2
	Canada*	515	-3		Romania	428	2
	Finland	511	-11		Kazakhstan	423	26
	Australia*	507	4		Bulgaria	421	-3
	New Zealand*	504	-4		Moldova	417	-12
	Ireland*	504	8		Malaysia	416	-21
	Switzerland	503	7		Mongolia	412	N.A
	Slovenia	500	-7		Colombia	411	-2
	United Kingdom*	500	-5		Costa Rica	411	-5
	United States*	499	-3		Mexico	410	-9
	Poland	499	-12		Thailand	409	-17
	Czech Republic	498	1		Peru	408	4
	Latvia*	494	7		Argentina	406	2
	Denmark*	494	1		Montenegro	403	-12
	Sweden	494	-6		Brazil	403	-1
	Germany	492	-11		Jamaica*	403	N.A
	Austria	491	1		Saudi Arabia	390	4
	Belgium	491	-8		Panama*	388	23
No difference	Netherlands*	488	-15		Georgia	384	1
	France	487	-6		Indonesia	383	-13
	Hungary	486	5		<i>Baku (Azerbaijan)</i>	380	-18
	Spain	485	N.A		North Macedonia	380	-33
	Lithuania	484	2		Albania	376	-41
	Portugal	484	-7		Jordan	375	N.A
	Croatia	483	10		El Salvador	373	N.A
Below	Norway	478	-12		Guatemala	373	8
	Italy	477	9		<i>Palestinian Authority</i>	369	N.A
	Türkiye	476	8		Paraguay	368	10
	Viet Nam	472	N.A		Morocco	365	-11
	Malta	466	9		Dominican Republic	360	25
	Israel	465	3		<i>Kosovo</i>	357	-8
	Slovak Republic	462	-2		Philippines	356	-1
	<i>Ukrainian regions (18 of 27)</i>	450	N.A		Uzbekistan	355	N.A
	Serbia	447	8		Cambodia	347	17

Table 2: PISA 2022 results for Science Literacy Performance (OECD, 2023)

		Math score 2022	Math score change from 2018			Math score 2022	Math score change from 2018
Above the OECD average	Singapore	575	6	Below the OECD average	Ukrainian regions (18 of 27)	441	N.A
	Macao (China)	552	-6		Serbia	440	-8
	Chinese Taipei	547	16		United Arab Emirates	431	-4
	Hong Kong (China)*	540	-11		Greece	430	-21
	Japan	536	9		Romania	428	-2
	Korea	527	1		Kazakhstan	425	2
	Estonia	510	-13		Mongolia	425	N.A
	Switzerland	508	-7		Bulgaria	417	-19
	Canada*	497	-15		Moldova	414	-6
	Netherlands*	493	-27		Qatar	414	0
	Ireland*	492	-8		Chile	412	-6
	Belgium	489	-19		Uruguay	409	-9
	Denmark*	489	-20		Malaysia	409	-32
	United Kingdom*	489	-13		Montenegro	406	-24
	Poland	489	-27		Baku (Azerbaijan)	397	-23
	Austria	487	-12		Mexico	395	-14
	Australia*	487	-4		Thailand	394	-25
	Czech Republic	487	-12		Peru	391	-9
	Slovenia	485	-24		Georgia	390	-8
No difference	Finland	484	-23	Below the OECD average	Saudi Arabia	389	16
	Latvia*	483	-13		North Macedonia	389	-6
	Sweden	482	-21		Costa Rica	385	-18
	New Zealand*	479	-15		Colombia	383	-8
	Lithuania	475	-6		Brazil	379	-5
	Germany	475	-25		Argentina	378	-2
	France	474	-21		Jamaica*	377	N.A
	Spain	473	N.A		Albania	368	-69
	Hungary	473	-8		Palestinian Authority	366	N.A
	Portugal	472	-21		Indonesia	366	-13
Below	Italy	471	-15		Morocco	365	-3
	Viet Nam	469	N.A		Uzbekistan	364	N.A
	Norway	468	-33		Jordan	361	-39
	Malta	466	-6		Panama*	357	4
	United States*	465	-13		Kosovo	355	-11
	Slovak Republic	464	-22		Philippines	355	2
	Croatia	463	-1		Guatemala	344	10
	Iceland	459	-36		El Salvador	343	N.A
	Israel	458	-5		Dominican Republic	339	14
	Türkiye	453	0		Paraguay	338	11
	Brunei Darussalam	442	12		Cambodia	336	12

Table 3. PISA 2022 results for Mathematics Literacy Performance (OECD, 2023)

For example, the arts have been included in the core STEM engagement and success programme in South Korea in order to reinforce the emphasis on innovation and design, known as STEAM (a more student-focused blend without sacrificing the substance) (Park et al., 2016; Cheng, 2022). Additionally, teachers are held in high regard, and STEM subjects are taught by discipline-qualified educators who practice what they know (Blackley and Howell, 2015).

Lastly, in developing nations with an emerging manufacturing and industrial sector and/or low levels of education involvement along with the availability of competent educators, like South Africa and Brazil, in the fourth group, STEM is discussed in terms of increasing basic

education attendance and developing a skilled teaching profession (Marginson et al., 2013).

The Historical Evolution of STEM Education: Insights from Blackley and Howell (2015)

The field of STEM education, which includes Science, Technology, Engineering, and Mathematics, has experienced major changes throughout several decades. In their 2015 paper, *A STEM Narrative*, Susan Blackley and Jennifer Howell deliver a detailed timeline created over 15 years that shows how STEM education has evolved. The authors use multiple figures to illustrate the main stages of STEM education development between the late 1990s and 2015. They analyse the factors that have both advanced and hindered authentic STEM practices globally, particularly focusing on the United States, the United Kingdom, and Australia. The research by these authors reveals both obstacles and advancements in STEM education by demonstrating how teaching methods evolved from isolated discipline instruction toward comprehensive integrated learning techniques.

Political Agenda Emergence (Late 1990s)

According to Blackley and Howell, STEM education's initial stage developed through political and economic initiatives. Between this period, governments acknowledged STEM fields as essential elements for fostering innovation and driving both economic growth and global competitiveness. Educational policies were established to boost student participation in STEM subjects due to these developments. STEM education policies were primarily driven by the need to meet workforce requirements instead of educational methodology considerations.

Fragmented Implementation (Early 2000s)

The initial stages of the 21st century saw STEM education programmes unfold in a disjointed manner. The timeline from Blackley and Howell shows educational institutions treated STEM as four separate subjects named Science, Technology, Engineering, and Mathematics, which people call S.T.E.M. The division between disciplines obstructed interdisciplinary education and reduced students' opportunities to solve real-world problems that required cross-disciplinary approaches. The absence of unified approaches during this timeframe demonstrated the difficulties faced by educational systems when trying to merge STEM subjects within existing education structures.

Skewed Focus (Mid-2000s)

According to Blackley and Howell (2015), STEM education in the mid-2000s showed a

disproportionate attention to Science and Mathematics. The timeline figures from this period show S.t.e.M, which reveals the marginalisation of Technology and Engineering fields. The educational imbalance developed because of restricted curriculums and limited resources combined with a traditional education approach that favoured science and math abilities. Technology and engineering maintained a vital yet unrecognised position in advancing problem-solving and innovation despite their marginalisation. Technology education taught students computational thinking and digital tools to solve real-world problems effectively. Engineering practices which lacked funding and curriculum representation inspired students through practical design learning that drove innovative problem-solving skills. The authors believe that full curriculum integration of technology and engineering would have allowed these fields to contribute more effectively to problem-solving and innovation during this era.

Rise of STEM Education (Late 2000s)

STEM education emerged as an integrated educational approach during the late 2000s instead of remaining isolated individual subjects. Blackley and Howell have identified an increasing awareness of the necessity for interdisciplinary methods that simulate real-life scenarios. The conceptual shift towards integrated STEM education did not eliminate the supplementary nature of many programmes, as STEM activities continued to be restricted to extracurricular events. The authors' timeline shows how instruction evolved from separate subject areas into an integrated educational approach.

Integrated STEM Education (2010s)

The last stage of the timeline spanning the 2010s marks the move towards genuine integrated STEM education. Educational systems started implementing interdisciplinary curricula to develop students' abilities to solve complex real-world problems. Blackley and Howell identify the necessity of transforming educational policies alongside teacher training and resource management to support this educational evolution. The timeline figures highlight how project-based learning and collaborative teaching methods became more widespread during this time frame.

STEM Pedagogy's Transition towards Integration

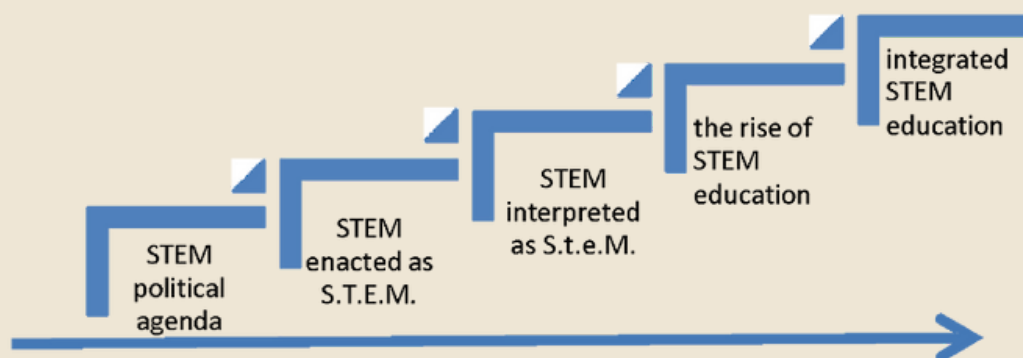


Figure 1: A STEM timeline – integrated STEM education. Source: Blackley and Howell (2015)

In conclusion, the timeline figures developed by Blackley and Howell in 2015 illustrate how STEM education developed from a political movement into a pedagogically sound integrated learning framework. The shift from teaching subjects separately to combining them in interdisciplinary approaches shows how educators now acknowledge STEM education's essential role in developing critical thinking and innovation. The historical timeline provides essential insights that guide future educational policy decisions and teaching methodologies as educational systems evolve.

Blackley and Howell's 2015 study presents basic insights into STEM education development history with a focus on the growing trend towards interdisciplinary methods. Their research provides important insights into the fundamental concepts of STEM education. Recent studies like Rifandi and Rahimi (2019) have advanced our understanding of STEM education by analysing its fit with modern requirements such as technological innovations and labour market expectations. To prepare students for today's fast-changing job market, Rifandi and Rahimi (2019) advocate for the integration of STEM competencies into educational curricula while pointing to worldwide initiatives that reinforce STEM education policies. While their evaluation provides modern insights, Blackley and Howell's (2015) framework continues to serve as a valuable tool for mapping STEM education developments and recognising ongoing challenges. The study bridges historical and current discussions by combining different perspectives within the larger academic dialogue. The approach demonstrates the necessity for STEM education research to be updated to incorporate current progress while filling a major literature void.

Challenges in Integrating STEM Education and Global Efforts to Address Them

STEM education integration is a worldwide priority but faces ongoing obstacles which limit

its effectiveness. The absence of a global consensus on an integrated STEM education framework produces definitional ambiguity and curriculum inconsistencies, which result in diverse interpretations and fragmented program executions (Peters-Burton et al., 2017). Many teachers face significant challenges in teaching STEM because they do not have adequate interdisciplinary education and professional development opportunities (Kibar et al., 2023). STEM program effectiveness faces additional limits due to resource constraints such as insufficient access to technology, teaching materials, and planning time (PMC, 2023). The rigid structures of curricula along with high-stakes testing prevent interdisciplinary teamwork and innovation within STEM education (Reinholz et al., 2014). The lack of inclusive teaching methods in many programmes causes continued student engagement and equity issues, which results in participation disparities within STEM fields for under-represented groups (SPORT-C intervention, 2023).

Global initiatives have developed to tackle these challenges and enhance STEM integration. The Next Generation Science Standards in the U.S. (National Research Council, 2013) and the STEM Alliance in Europe (European Schoolnet, 2017) represent standardisation initiatives that work towards developing unified curricula designed for interdisciplinary education. To tackle teacher preparedness problems, governments and institutions initiated training programmes such as STEM Education for Global Leadership in the U.S. and Singapore's STEM Applied Learning Programme to develop educators' abilities to deliver integrated STEM instruction effectively (Bybee, 2013). Finland and South Korea have directed substantial investments towards their STEM infrastructure, which provides schools with contemporary laboratories and technological resources along with thoroughly developed curricula (Marginson et al., 2013). The STEM and Gender Advancement (SAGA) project from UNESCO drives policy reforms and institutional support by working to eliminate systemic barriers and advance gender inclusivity in STEM education (UNESCO, 2017).

Outreach and inclusion programs exist to boost STEM participation, especially among groups that have been under-represented. The STEM Equity Monitor in Australia and the UK's STEM Ambassadors Scheme implement mentorship programmes while also adapting curricula and engaging communities to enhance STEM accessibility (Archer, DeWitt and Osborne, 2015). Teach For All and the African Institute for Mathematical Sciences (AIMS) provide STEM opportunities for underserved communities in developing nations (Vossoughi and Bevan, 2014). The persistent challenges of STEM integration remain evident, but these worldwide initiatives demonstrate an increasing dedication to overcoming educational barriers while enhancing learning results (Honey, Pearson and Schweingruber, 2014). Stakeholders around the globe are making progress in dismantling barriers to STEM education through curriculum improvements and expanded teacher training while increasing funds and implementing inclusive policies.

STEM education integration worldwide is hindered by ambiguous definitions, teacher inadequacies, insufficient resources, set curricula, and inequities. Many multinational projects are addressing these issues by introducing standard educational materials, training

instructors, investing in infrastructure, and supporting inclusive behaviours. Global initiatives are promising, but an inclusive and functional STEM education system is doubtful.

Priorities for STEM Education: Innovation and Equity

Two key priorities emerge when assessing STEM education: fostering innovation and ensuring equity. Creative-focused education programmes serve as essential tools for preparing employees who will drive future technology breakthroughs. A diverse and inclusive talent pipeline depends on equitable STEM education access for all students. The following analysis examines these priorities through evidence collected from international research and practical case studies.

1. Fostering Innovation in STEM Education

STEM education innovation remains essential to equip students with the skills needed to succeed in the fast-changing technological environment. Research by Kozma (2011) reveals that digital tools combined with project-based learning methods improve problem-solving abilities and help develop essential skills for the 21st century. Different educational systems globally have implemented multiple innovative practices to reach this educational objective.

The Finnish Phenomenon-Based Learning (PhBL) model supports interdisciplinary education by motivating students to investigate real-world issues through inquiry-based learning and experimental methods (Sahlberg, 2015). The approach leads to creative thinking development and critical analysis abilities which serve as foundational elements for innovation. Singapore's The Applied Learning Programme (ALP) uses hands-on projects and partnerships with industry experts to connect theoretical knowledge with real-world applications (Tan et al., 2021).

STEM teaching methods are undergoing transformation through the application of new technologies, including artificial intelligence (AI), virtual reality (VR), and augmented reality (AR). Research by Li et al. According to Li et al. (2022), VR-enhanced labs boost student spatial reasoning and engagement specifically within engineering courses. The AI4K12 programme teaches AI fundamentals to K-12 students in the United States to equip them for upcoming technological changes (Touretzky et al., 2020).

2. Ensuring Equity in STEM Education

Globally, STEM education faces the ongoing critical challenge of achieving equity. Significant disparities continue across gender lines and between different socioeconomic levels and geographic areas even though progress has been made (UNESCO, 2021). The path to equity requires eliminating participation obstacles while delivering specific support and developing environments that promote inclusivity.

The United States has programs like Girls Who Code, which, since starting, have enrolled more than 500,000 participants and have enhanced female participation in computer

science fields (Ashcraft et al., 2012). The African Girls Can Code Initiative (AGCCI) supports young women in Sub-Saharan Africa by teaching them coding skills and digital literacy to help create a more gender-balanced tech sector, according to UNESCO (2022).

Digital inclusion initiatives work to resolve socioeconomic inequalities. The DIKSHA platform from India delivers open educational resources to students and teachers nationwide, which helps lessen learning disparities in underserved communities (Government of India, 2021). The One Laptop per Student Program in Brazil has provided technology access to students in low-income regions while promoting both digital literacy and STEM subject engagement as identified by Oliveira et al. (2020).

3. Integrating Innovation and Equity: A Balanced Approach

Achieving long-term progress in STEM education requires simultaneous advancement of both innovation and equity measures. Research by Marginson et al. (2013) demonstrates how technological advancements need to be paired with educational practices that support inclusion. Sustainable advancements in STEM education require ongoing teacher development and curriculum updates that incorporate diverse cultural views alongside industry partnerships for practical learning.

The STEM Equity Monitor in Australia tracks demographic group participation rates and uses this data to guide inclusive policy improvements (Australian Government, 2023). Through the Horizon Europe programme: the European Union provides funding for classroom digital tool integration projects that focus on giving priority access to disadvantaged communities (European Commission, 2021).

The continued advancement of STEM education depends on maintaining a balance between innovative practices and equitable access. Educators who utilise modern technologies while promoting inclusive practices and matching educational strategies to societal demands will develop a skilled workforce that can meet future challenges. Research-based policies combined with international cooperation are essential for reaching these objectives.

Enhancing STEM Education Through Innovative Pedagogic Strategies and Effective Leadership

Bybee (2013) argues that contemporary educational systems globally acknowledge STEM education as their foundation. As Marginson et al. (2013) illustrate, countries worldwide emphasise STEM education to remain competitive. With accelerating technological advancements, the importance of effective STEM education becomes even more critical (National Science Board, 2015). Levin (2012) highlights that success in STEM education relies on a combination of innovative teaching methods and strong leadership practices. This combination might provide solutions to new STEM education challenges, including

disparities in access to resources, changing professional requirements, and the integration of multiple disciplines. This section examines leadership research in STEM education alongside innovative teaching methods and explores the role of leadership in applying these methods to enhance educational results.

The Role of Leadership in STEM Education

Current studies demonstrate that leadership functions as a critical component in developing STEM educational procedures. According to Yokota (2020), robust leadership establishes the foundation needed to build educational settings that support innovative teaching methods. STEM educational leadership reaches beyond administration by implementing pedagogic leadership which triggers change through methods based on evidence. The leadership models of transformational leadership (Leithwood et al., 2020) and distributed leadership (Spillane et al., 2019) provide insights into how leaders can start collective initiatives and help teachers adopt new educational practices. Transformational leadership aims to establish innovative STEM education environments by creating visions and motivating staff with personalised support.

The 2017 study by Cannata et al. underscores the crucial role of situational leadership because it adapts educational methods to meet the various needs of learners. This teaching method is consistent with differentiated instruction models that cater to diverse student abilities while fostering active learning. Wang et al.'s 2022 research show that adaptive leadership successfully tackles main STEM education challenges, including technology integration and equity gaps. The research results highlight how adaptive leadership serves as a crucial factor for successfully introducing new technologies and enhancing inclusivity. Upcoming research needs to investigate the effects of additional leadership models, including servant leadership and instructional leadership, on student participation and academic results in STEM education with special attention to marginalised groups.

Integrating Leadership and Innovative Pedagogic Strategies

Transformative teaching practices in STEM education require effective leadership to achieve successful implementation. The research by Sebastian and Allensworth (2012) shows how leadership plays a vital role in adopting new teaching approaches successfully. They affirm that it is essential for mobilising resources while ensuring curriculum alignment and creating collaborative teacher environments. Leadership approaches based on systems thinking (Senge, 2006) and collaborative leadership (Chrispeels, 2004) enable leaders to manage complex educational systems and establish stakeholder partnerships that include teachers, students, and community members. Leaders should maintain a focus on continuous professional development (CPD) to keep educators skilled in current teaching methodologies. Research by Voogt et al. (2015) demonstrates that professional learning

communities (PLCs) improve both teacher collaboration and innovative practices in STEM education. Leaders need to implement adaptive strategies that include data-driven decision-making and growth mindset development among educators because STEM fields are evolving rapidly. Leaders face the challenge of maintaining operational stability while simultaneously fostering innovative practices in STEM education.

Optimizing Interdisciplinary Collaboration

STEM educational outcomes can reach new heights through the combination of leading-edge leadership approaches with creative teaching methods. The research of Leithwood et al. (2020) highlights how transformational leadership plays a critical role in developing settings that support innovation. Schools can create customised strategic initiatives for their particular needs by utilising findings from recent research. Through interdisciplinary collaboration, which benefits from boundary-crossing leadership concepts (Akkerman & Bakker, 2011), educators can learn how to apply joint problem-solving methods that reflect actual STEM industry challenges. Educational settings that integrate artificial intelligence (AI) and virtual reality (VR) into learning environments are proving to be effective tools for STEM education, according to recent findings (Hwang et al., 2023). Leaders who support these technologies can enhance the performance of innovative teaching strategies. Perhaps future investigations need to examine ways to improve interdisciplinary collaboration for various learning environments, especially within areas that lack resources and culturally heterogeneous communities.

Effective leadership is essential for progressing STEM education through support for innovative teaching methods alongside resolution of educational obstacles and promotion of cross-disciplinary cooperation. Educational environments evolve dynamically through transformational, distributed, and adaptive leadership models which support technological integration and equity alongside ongoing professional development. The integration of leadership approaches with new technologies and team-based teaching methods leads to improved student engagement and better learning results. Further investigation must evaluate how leadership approaches affect various educational environments, especially those serving marginalised communities, to achieve inclusive and quality STEM education for learners.

Conclusion and Future Directions

Throughout its historical evolution, STEM education has adapted continuously to meet the demands of our rapidly changing world. Through focusing on inclusivity and innovation and staying updated with international trends, educators and policymakers can equip students to handle future challenges and opportunities. The advancing STEM education field requires ongoing research, which must be performed through cooperative efforts that link

educational professionals and policymakers with industry experts to achieve global progress. Worldwide efforts to integrate STEM education into curricula face multiple obstacles, such as unclear definitions paired with teacher inadequacies and insufficient resources, as well as fixed curricula and existing disparities. Numerous international projects are currently tackling these obstacles by implementing standard educational materials and training teachers while investing in infrastructure and promoting inclusive practices. The Next Generation Science Standards, together with the STEM Alliance and the SAGA project, exemplify an expanding dedication to promoting interdisciplinary STEM learning while advancing educational equity. Global efforts show advancement, yet it's uncertain if they will establish an inclusive and functional STEM education system. Therefore, research should explore how can policymakers work together with educators and institutions to develop better methods for providing equal educational access and meaningful interdisciplinary learning experiences? The rising demand for STEM skills in today's evolving world prompts us to evaluate necessary actions for bridging educational gaps and preparing future generations to meet upcoming challenges.

The continued advancement of STEM education depends on maintaining a balance between innovative practices, equitable access and effective leadership practices. Educators who utilise modern technologies while promoting inclusive practices and matching educational strategies to societal demands will develop a skilled workforce that can meet future challenges. To reach these objectives, research-based policies and international cooperation must work together effectively. Multiple studies demonstrate that strong leadership is essential for confronting STEM educational challenges through transformative teaching methods and the creation of flexible educational spaces designed for the future. Through this relationship, educational institutions stand to strengthen STEM education, which will provide learners with essential technological skills for future success. Further research should examine how leadership-initiated teaching improvements affect education over time within various cultural and socio-economic backgrounds. More studies should investigate the ways educational policies might enhance leadership development in STEM education through strategic funding allocation as well as mentorship initiatives and collaborative institutional partnerships. Even furthermore, probing questions could be asked: What strategies can global partnerships and policy structures implement to enhance STEM education leadership to tackle new challenges like climate change and digital transformation as well as workforce preparedness?

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‘DRAMA’ AS A PEDAGOGIC TOOL FOR THE MARGINALISED IN INDIA: ROUTES FROM A RHIZOMATIC PAST-PRESENT EXPLORATION

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Abstract

With India’s National Education Policy (2020) giving focus to quality education especially for historically marginalized and disadvantaged groups like Adivasis and Dalits, this review paper provides a past-present kaleidoscope on which to reflect for pedagogic transformation.

The paper makes connections by tracing through strands of past and present educational landscapes of India, exploring the scope for locating a future for ‘drama’ as a pedagogic tool for marginalized communities in India. This integrative approach to a literature review connects across times, representing routes within a rhizomatic (Deleuze and Guattar 1987) pattern.

The paper flushes out inconsistent relations present between the Adivasi/tribal communities and their state educational provision, which instil in children values and traditions associated with mainstream rather than local culture. The issue highlights tensions tribal populations experienced in the past, in the hands of colonial rule and later during the nationalists phase (Xaxa, 2021). Continuing into the historical route, the paper then takes a closer look into the impact of a colonial system of education in which there came a prevalence of a “textbook culture” (Kumar, 1991). As a response, there emerged sprouts of movements turning to alternative educational ideals and practice by Indian educational thinkers, for example, Tagore and Gandhi, with an emphasis on ‘learning by doing’ (Gupta 2010).

At this point the review paper takes a re-route, focusing upon certain historical milestones in drama and theatre traditions of India. The scope of Indian traditions in drama and theatre in the review begins with an overview of ‘Natyasastra’ a traditional Indian text on the “the science of theatre” (Bharhanpurkar, 1992). Opening windows into the colonial period, theatre was used as a tool for political education and propaganda during the nationalist movements (Richmond, F., 1973). The post-colonial period, again presented theatre as a way to promote progressive ideologies and also science education (Richmond, F., 1973, Mannathukkaren, 2013).

The final re-route occurs by connecting present and past, narrating various discourses which are about the struggles of the oppressed for gaining voice and altering social hierarchies through education. This again points to the present in which the conditions of marginalized

communities, reflect a 'hegemony of knowledge' in which the privileged still prevail. Through the past-present non-linear connections, I shed light on possibilities for connecting the potential of drama pedagogy to various other routes discussed, leading to questions about the possibility of drama becoming a tool for a 'transformative and liberative pedagogy' (Heredia, 1995) for the marginalized. By taking the notion of routes from a rhizomatic way of making connections, the paper provides a platform for routes to emerge, conceptualizing past-present connections, enabling possibilities to re-route and re-connect at various interjections. This raises imperative questions for the education of marginalized communities in India for quality education.

Introduction

In India, particularly for marginalised communities, education has long represented a space of possibility—yet one laden with persistent exclusions. This article adopts a non-linear, rhizomatic review approach (Deleuze & Guattari, 1987; Honan & Sellers, 2006; Fox, 2024) to explore literature by weaving together historical, cultural, and pedagogical threads relating to Scheduled Caste (SC) and Scheduled Tribe (ST) communities¹. A rhizomatic review facilitates exploration in an "open-ended, non-linear pattern, searching across disciplines, following connections, and engaging in an iterative process of research synthesis" (Fox, 2024). Rooted in the ontological frameworks of new materialism and posthumanism, this method emphasises "following the action or the flow" (Fox, 2024), rather than adhering to a fixed trajectory.

Fox (2024) outlines certain key principles for undertaking such reviews, given that this approach is still emerging within academic practice. First, rather than being guided by a rigid research question, the present review aligns with the idea of "following the flow" (Fox, 2024), navigating through topics such as colonial education in India, tribal education, a historical perspective of drama in Indian society, and theatrical practices during the colonial period—"meandering like a river" (Fox, 2024). Secondly, in alignment with Fox's (2024) recommendations, this review does not employ strict inclusion or exclusion criteria, thereby allowing for more diverse insights. Thirdly, the review traverses interdisciplinary and multidisciplinary terrains, drawing from the fields of education, drama, and theatre studies. The fourth principle is the iterative nature of this methodology. In this study, these iterations are conceptualised as 'routes', through which connections are traced across time—past and present—in a non-linear manner. Fifth, as Fox (2024) notes, the rhizomatic review is not intended to identify gaps in the literature. Consistently, this paper does not aim to highlight gaps but rather to map connections and possibilities. Finally, this rhizomatic review process does not culminate in a traditional conclusion; instead, it opens up potential pathways for research questions and empirical inquiry.

¹ Scheduled Tribe and Scheduled Caste are considered to be the most disadvantaged communities who have been historically marginalized in India.

Structured through four interwoven routes, this article argues that drama holds transformative potential as a pedagogical tool for marginalised sections (SC and ST) in India. At the same time, it acknowledges that new directions and arguments may emerge through further iterations. In light of India's National Education Policy 2020, which underscores the need to support historically marginalised communities, this rhizomatic, connection-based review presents a compelling model for reimagining education through radical, inclusive lenses.

Past and Present: Where does it lead to?

Route 1: I start by narrating a finding that was observed through the 6-month-long ethnographic study conducted by Maithreyi, Prabha, and Viknesh (2022) in a tribal village at Gudulur, Tamil Nadu, a southern state in India. The study narrates the inconsistent relation between the Anganwadi which is the centrally organised early childhood care, and the village community. Through the informal interviews of the community members, it was observed that the children were taught about the local festivals, rhymes and cultural aspects of the dominant communities. Further, the community members claimed that devoid of any photos or text related to the tribal culture in the textbooks of the children, the centres were instilling the dominant cultural values in the children. This observation from the ethnographic study from South India raises curtains to the tensions and climate that the tribal population underwent in the past. Xaxa claims that tribal populations have always been considered as “primitive and savage” (2021), first by the colonialists, then as “uncivilised or jungle” (2021) by the nationalists. The colonial government, with the aid of the missionaries, strived to remove the Adivasis from practicing their traditional lifestyle and slowly tried to erode their language and culture. Tribal culture and ethos were replaced for the Christian-evangelic values and practices. While coming to the nationalists, they tried to assimilate the tribal population to the national Indian culture and ethos; here, unlike the colonialists, the nationalists aimed at instilling the ethos of the dominant regional culture, entailing “rigid social structure of hierarchy and lack of freedom” (2021). He also criticizes the curriculum which is followed as satisfying the needs of the dominant subnational population, thus following alien languages for the children from ST communities. He talks about the cultural marginalisation caused thus as ‘cultural violence’, which the Indian population still continues to perpetuate, and thus criticising the overlooking done even by the educational policies.

Route 2: Now this triggers our attention to continue to look back into the history into the colonial periods, which offers an interesting correlation. Before the advent of the British in India, studies show the educational system which was prevalent on Indian soil was through *pathsalaas*, *madradas*, *tols*, *maktabs* and *gurukulas* (Basu, 1985). With the introduction of the colonial system of education, there came a “textbook culture” where the textbook was the “de facto curriculum”, giving importance to memorisation and rote learning (Kumar, 2005). Kumar goes on to further state that this education system implemented by the colonial

system was bereft of any space for the “indigenous² knowledge and cultural forms in India”.

The children were taught in the values of the colonisers, thus making the school curriculum “dissociated” from the everyday lives of the children. In an earlier work, Dharampal (1989) had already emphasised the point that the “indigenous education” of India suffered from the advent of the colonial education system. Another extension of this discussion is that the access to the colonial education, specifically the English language education, was received only by the elite and privileged sections of the society, i.e., the Brahmins (Kumar, 2005). From this elucidation one can see the similarity of practices done by the colonialists to the Indian population and the nationalists to the tribal population during the post-colonial times as referred to by Xaxa (2021). Further, we can also see that by the advent of the British, the emphasis of education was for “academic proficiency” (Gupta, 2019).

As a response to the introduction of the British system of textbook education, prominent educational thinkers like Sri Aurobindo, Mahatma Gandhi and Rabindranath Tagore contributed to bringing in alternative educational ideals emphasising on ‘learning by doing’ in colonial and post-colonial periods (Gupta 2019). Among them, Tagore’s ideas drew my attention, as there was a prominent emphasis given to the arts and movement.

For Tagore, who was a renowned poet, writer and philosopher, the idea of movement and imagination was integral to the educational philosophy. In his words:

“We often take a brisk walk when we are agitated, because thought needs bodily expression if it is to perform its work freely and fully. Children must dance; they must be restless. when they think, the body becomes restless and ripples with a variety of movement that helps to keep their muscles in harmony with the mind” (Tagore, 1961, p. 102)

Tagore's vision of education emphasised the importance of aesthetic development alongside intellectual growth. He advocated for the integration of various fine and performing arts into daily school activities, believing that such practices were essential to nurture children and their souls (Lesar, 2015). His goal for education was to achieve holistic development, allowing children to live in harmony with the world around them. Tagore's approach to education was deeply rooted in spiritual development, where the highest form of learning not only imparts knowledge but also fosters a sense of harmony with all existence (Lesar, 2015). According to him, true harmony can be realised when all aspects of an individual—intellectual, physical, moral, social, and aesthetic—are fully cultivated (Lesar, 2015).

Route 3: With that emphasis given to the idea of movement and aesthetics in children’s education by Tagore during the 19th and 20th centuries, this review takes a re-route to dig a different historical trajectory; a historical trajectory of Indian drama and theatre traditions,

² Here the term indigenous referred broadly to the Indian knowledge systems as opposed to the British western.

with a particular focus on their significant milestones. Bharhanpurkar's (1992) thesis offers a comprehensive review of the country's traditional theatre and drama forms. The review provides an overview of the *Natyasastra*, the earliest known Indian text on theatre, written by Bharatha Muni around 200 BC. According to the review (Bharhanpurkar, 1992), Indian theatre and drama evolved since 2500 BC. The term *Natyasastra*, which translates to "the science of theatre", delves into the aesthetics and forms of ancient Indian theatre, which is primarily represented by the Sanskrit theatre tradition. The text also highlights how the arts have transcended social barriers in India, remaining accessible to all segments of society. Bharata, the author, emphasises the power and versatility of drama when he states, "There is no wise maxim, no learning, no art or craft, no device, no action that is not found in the drama" (1992, pp. 148). Bharhanpurkar (1992) emphasises the significance of Indian theatre as a way of life, where art is integrated into daily activities and rituals. Indian traditional theatre forms according to the *Natyashastra* are categorised into three levels that correspond to the three levels of Indian society: tribal, village, and urban (Bharhanpurkar, 1992). Artistically, these levels are classified as tribal, folk, and classical. Tribal forms of music, dance, and movement are given as deeply ingrained in the everyday activities and lifestyles of the communities. These arts are closely linked to the ritualistic traditions of the community's daily events. At the village level, what is known as folk is often the songs, stories, and movements revolving around agriculture. Harvest and seasonal activities are prominent themes in folk traditions. In the urban level, which is associated with sophistication, classical art forms are relevant, which are text-based and different from the oral structures of tribal and folk forms. Bharhanpurkar (1992), referring from *Natyashastra* further states that Indian theatre, drama, dance, or music encompasses words, movements, and sound, and not any of these elements in isolation. These forms of expression have served as a medium for transferring and disseminating information and knowledge to the communities, whether it is about legends, myths, or their daily activities, rituals, and seasonal lore Bharhanpurkar (1992). In this sense, traditional Indian theatre and *Natya* forms have been educational in some sense.

Drama and theatre during colonial and postcolonial times

In modern-day India, the late nineteenth century saw the use of theatre as a means of political education, propaganda, or publicity among the citizens (Richmond, F., 1973). Known and publicized today, *Nildarpan* a Bengali play that was showcased in the 1960s, became the first play of 'social protest' in India opposing colonial brutalities. This play focused on the exploitations performed by the British Indigo Planters in the Indigo Plantations (Richmond, F., 1973, pg 319). Tagging along the similar lines of *Nildarpan*, plays in Marathi in Maharashtra and plays in Madras were staged, which adopted a political line as a 'social protest'. As a result, the British government issued the Dramatic Performance Act No. XIX on March 14, 1879. Later, with the advent of the Indian National Congress in 1885, there were many theatre performances where the scripts were "veiled allegories" that communicated nationalistic content to the audience (Solomon, R.H., 1994, Richmond, F., 1973).

With India entering into its post-colonial phase, theatre was used to communicate party-specific political ideology too. This use of theatre created a huge movement in moulding public opinion (Richmond, F., 1973). In the 1950s in Kerala, a South Indian state (which is the specific geographical location for my research), theatre became an “instrument of social criticism and a weapon of social change” (Mannathukkaren, 2013). One such very significant example is that of the state of Kerala and the activities of the theatre troupe Kerala People’s Arts Club (KPAC). KPAC’s drama *Ningalenne communist aaki* (You made me a Communist) was performed on numerous stages, over 600 of them, throughout Kerala. The songs of the play are used by the communist party in Kerala even in this age to instill a sense of commune and unity throughout the state for the people to the party.

During the 1960s there was a different attempt at the use of theatre, this time more focused specifically towards an educational goal. For Kerala Shasthra Sahithya Parishad (KSSP), an organisation promoting science and literature among communities in Kerala, the theatre performances were part of an educational activity. Teachers and adult students who were part of the KSSP were trained under the theatre practitioners, and they created plays and songs which they organised and presented among the countryside as a ‘jatha’ or ‘cultural caravan’ (Pattnaik, B.K. and Sahoo, S., 2014). The plays are performed in the town square, where the caravan group enters the town by beating the traditional instrument ‘chenda’. They then presented plays about ecological, scientific, and even social issues (Eldhose, A.Y., 2014).

Route 4: I again track back to the ethnographic study by Maithreyi, R., Prabha, K. and Viknesh, A., (2022) in the tribal village in Tamil Nadu. Another observation from the informal interviews show that the community members and parents were not objecting to the modern education provided to their children, but with it, they wanted it to “serve their community’s purpose” and also “have control over it”. The members in infact gave real importance to formal education since they wanted their children to be able to read the written governmental contracts and engage in administrative communications to avoid any more exploitation. This observation from the response of the participant draws us back to the educational discourse during the colonial period. Kumar (2005) states that one of the quests during the independence struggle was in seeking “social justice” for the “downtrodden castes” in India in gaining educational opportunities that they were denied. The demand put forward to the colonial government was focusing on the monopoly of the educational and job opportunities by the Brahmin caste, which is situated in the higher rungs of the caste system. Educational thinkers and leaders who belonged to the oppressed population believed that education was the transformative tool capable of altering the established social hierarchy. According to Dr B.R. Ambedkar, who was the most prominent scholar and philosopher who spoke for the rights of the downtrodden community or the Dalits, “Education is something which ought to be brought within the reach of everyone.” (Ambedkar 1982: 40). He saw education as having the power to emancipate the Dalits en route to higher social mobility. In the contemporary dalit scholarship, scholars like Kancha Illiah see that English education for the dalit communities will lead to their social

emancipation (Ilame, 2020).

Discussing the emancipation and transformation that education can bring for the marginalised sections, Heredia (1995), in his paper, puts forward an argument for the creation of a “transformative and liberating pedagogy” for the tribal communities. He calls for a form of development for the tribal communities where the idea of tribal integration will not only emphasise preserving their cultural autonomy but also strongly redress their “minority” status. Giving a pedagogic implication of this, he emphasises the need for the teachers to adorn the role of “transformative intellectuals” (Heredia, 1995), who are not subscribed to the dominant power interests.

To this call, the present situation faced by the tribal children in the formal schools lay bare providing us an assorted view. Rupavath (2023) states that the education provided for the Tribal children in the existing system is like a ‘banking system’ where it is a “one-way process”, and the teachers are the depositors of the knowledge. Through the interviews that his study conducted, the students tended to raise the issue of being scared to respond in class, a language gap issue in terms of the medium of instruction and the relationship between the teacher and the students. The study says that all these factors decide the lower participation of children in classrooms, leading to higher dropout rates, which is still highly prevalent.

Adding on, Sunder (2010) states in a study that with teachers having no knowledge of the indigenous language and the textbooks adopting the language of the dominant society, there occurs a linguistic alienation for the Adivasi children in formal schooling. In another complex situation, in some of the Adivasi communities, the parents of the children do not expect the school to teach their indigenous language; rather, they prefer the teaching of the dominant state language, enabling the children to get an education in a language that will equip them to deal with “bureaucracy and non-ativasis”. Adivasi children are also denied their ‘culture and history’ by formal schools following the curriculum of the mainstream privileged ‘urban-middle-class’ population. This denies their innate cognitive abilities. Moreover, the textbooks rarely represent the Adivasi communities, and the only discussions surround the Adivasi backwardness. In similar lines, Manojan K.P. (2019) strongly supports the opinion that the education provided is highly focused on ‘reproducing existing inequalities’, where the privileged are the only section that can fully utilise and make use of the opportunities to their best, while the children from subaltern communities are left out. He argues this by pointing out the ‘hegemony over knowledge’ present in the school education system in the form of curriculum, creating ‘a sense of estrangement’ among the children. The reason for this is the ‘alien’ content of the curriculum which is failing to develop ‘the innate cognitive abilities’ of the children. He opines that the children are “forced to attach with the concepts and operations mechanically without being involved in the active process of constructing knowledge” (Manojan K.P., 2019). In a way of stating a solution Sundar (2010) concludes that schooling that would impart knowledge enabling the Adivasi children to show their mark in formal employment but also that retains and upholds Adivasi culture and

Indigenous knowledge is an “ideal model” (Sundar, 2010).

Meeting at a Junction: Is ‘Drama’ the chosen one?

By taking the above routes in exploring around the educational landscape of India, I realise that this rhizomatic way of understanding the area plunges us to different layers and depths of the issue surrounding the education of the marginalised populations. Even though I have stopped my exploration narrated here at only 4 routes, I understand that the narrations will take different directions iteratively, routing and re-routing with time and depth. From the routes presented here, let’s iterate the key ideas to see where it will meet. I’m interested in bringing into the spotlight Route 3, which unpacked the milestones around drama in India. It was seen that there is the presence of urban, tribal and folk forms of theatre and arts; it was seen that drama played a key role as a political tool during the colonial struggle and also in Kerala to communicate communist ideals to the people. And also, as a tool for instilling consciousness towards science education in Kerala. How can we locate this route on a map, in association with other routes? I see this association in the form of multiple emerging questions and possibilities. Can drama be that “transformative and liberating pedagogy” that Rudolf Haredia puts forth, where the teachers can take the role of the ‘transformative intellectuals’ being artist-practitioners? Can drama serve as a tool to break the ‘banking system’ and the ‘one-way process’, reducing the distance between the teacher and student, where the student is no more scared of the teacher? Can drama help in bringing in fun and play into learning and remove the remnants of rote learning, the remains from the colonial past? Can drama break the ‘hegemony of the knowledge’ by the privileged by being able to capture and represent the cultural ethos of the marginalised community’s worlds through the pedagogy? Can drama engage children in the active process of knowledge creation? And finally, can drama remove the self-construction of inferior identity (Balagopalan, 2003) by the marginalised student based on the ascribed constructions by the dominant society? The questions and possibilities to associate the routes are many.

Conclusion

In this rhizomatic process of reviewing, I reflect that the routes explored here are mostly related to Scheduled caste and Scheduled tribe communities who are termed among the socially disadvantaged groups by the government of India. But since the concept of marginalisation is a broader and complex one, the situation of marginalisation can be determined by various factors, such as poverty, education, race, ethnicity, disability, gender, sexuality, culture, religion, and personal circumstances like being a refugee or migrant (Giri, 2021). And for each section of marginalised experiences, different routes and strands will evolve with iterations. As the routes evolve, meandering through topics, the possibilities of the associations and questions evolve in various directions. Further, in the next stage, the empirical explorations that will be conducted through my research in India among tribal children of Kerala will look into the possible potential of drama as a transformative tool. Thus, I leave this rhizomatic review at this point, with certain pertinent questions and discussions, yet not closing it, but opening it to the iterative process of knowledge assimilation and generation.

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FROM HUMAN HANDS TO ALGORITHMIC MINDS: WHAT IF MACHINES BECOME COLLABORATORS IN ARTISTIC CREATION?

Marta Staff, University of Exeter; Jo Butts; and ChatGPT¹

Abstract

The nature of consciousness remains a central debate in the philosophy of mind and cognitive science, with no unanimous definition or understanding of its essence. At its core, consciousness involves the first-person experience of sensory perception, thoughts, feelings, and other mental states- the subjective awareness of “what it is like” to have a particular experience.

Conceptualisation, the ability to form mental representations of abstract ideas, plays a pivotal role in translating creative visions into tangible works. Artist's assistants and ghost writers are established practices showing how artistic creation often transcends sole authorship, with conscious collaborators realising another's vision. Meanwhile, the recent advent of AI-based tools capable of *generating* art or responding to prompts has led to a new debate - whether these approaches are mere tools, or true collaborators complementing (or even replacing) human creative input?

This essay blends narrative storytelling and academic inquiry, utilising a dialogue between Achilles and Tortoise, iconic figures from Zeno's paradox - a well-known philosophical thought experiment that challenges our understanding of motion and infinity- to examine phenomena such as algorithm aversion, appreciation, and AI's impact on authorship. If conceptualisation is central to artistic creation, does it matter whether authorship and creative input gets delivered by an artist's assistant or by AI? Long accepted in artistic endeavours, an assistant serves as a touchstone, much like AI-assisted art, both relying on non-primary creators to bring a vision to life. Yet, AI raises additional questions: Can “an algorithm” act as a true collaborator? Does its lack of consciousness undermine its creative output, or could its precision give rise to new forms of art?

Drawing from different research strands and playful examples, this essay raises critical questions about creativity, authorship, and technology's impact on artistic creation. While empirical data is yet to be collected, the discussion aims to stir debate on whether AI diminishes the essence of artistic vision, or instead offers opportunities for extending the boundaries of creative potential?

¹ChatGPT version 3.5 “as a collaborator” for writing poems

Preface

This piece takes a reader on a “rather unique” exploration of creativity, consciousness, and artificial intelligence, blending philosophical dialogue with poetic reflection. Structured as an interplay between mythological characters engaged in critical discussion, it bridges classical philosophical inquiry with contemporary artistic dilemmas. The dialogues between Achilles and Tortoise (in blue font) serve as a platform to examine the evolving relationship between human and machine-generated art, questioning the boundaries of authorship, artistic agency, and the role of AI in creative expression.

A key element is a poem entitled “AI-ing up Humanity” by Jo Butts, which serves not only as an artistic creation in its own right, but also as a prompt for ChatGPT to imitate. This interplay between human and AI-generated poetry invites the reader to reflect on the shifting nature of artistic collaboration.

Rather than offering definitive answers, this work encourages exploration and debate in the era where lines between human and machine are getting increasingly blurred.

Main body

In a playful reunion that defies the boundaries of time and space, the characters of Achilles and Tortoise, re-introduced by Lewis Carroll (1894) and Douglas Hofstadter (1989) in their take on Zeno’s paradox (visualised in Figure 1), find themselves engaged in a lively discussion that revolves around the dynamically evolving areas of art, consciousness and artificial intelligence². As they rekindle their acquaintance, recalling past encounters, they explore the intriguing relationship between creativity and technology. Achilles, adorned in a Roman centurion’s outfit, symbolises the power of liberation, highlighting the ability to adopt different personas. Their dialogue ventures into algorithmic aversion, a fascinating psychological phenomenon describing “individuals exhibiting negative attitudes and behaviours toward algorithms” (Yu, 2023), and permeates various domains. Achilles’ momentary disorientation serves as a tangible representation of this intricate relationship between humans and algorithms. In a succinct yet thought-provoking dialogue, Achilles and Tortoise guide readers through the nuances of consciousness, creativity, and artificial intelligence. With humour and insight, they invite us to reflect on the evolving landscape of human expression and the transformative potential of technology in shaping our perceptions of art and creativity. To further explore the relevant concepts, we revisit the familiar pair of Achilles and Tortoise, who engage in a “timeless” dialogue that intends to bridge theoretical debate and modern artistic dilemmas.

² As artificial intelligence (AI) systems rely on algorithms such as machine learning or search algorithms to process data and make decisions, referring to them as ‘algorithms’ is a simplification adopted by the author for ease of communication. Throughout this text, ‘AI’ and ‘algorithm’ are used interchangeably to simplify terminology.

The two long standing friends meet on a Zoom call, after a couple of decades of being hibernated, engaging in dialogue style of Lewis (1894) and Hofstadter (1989).

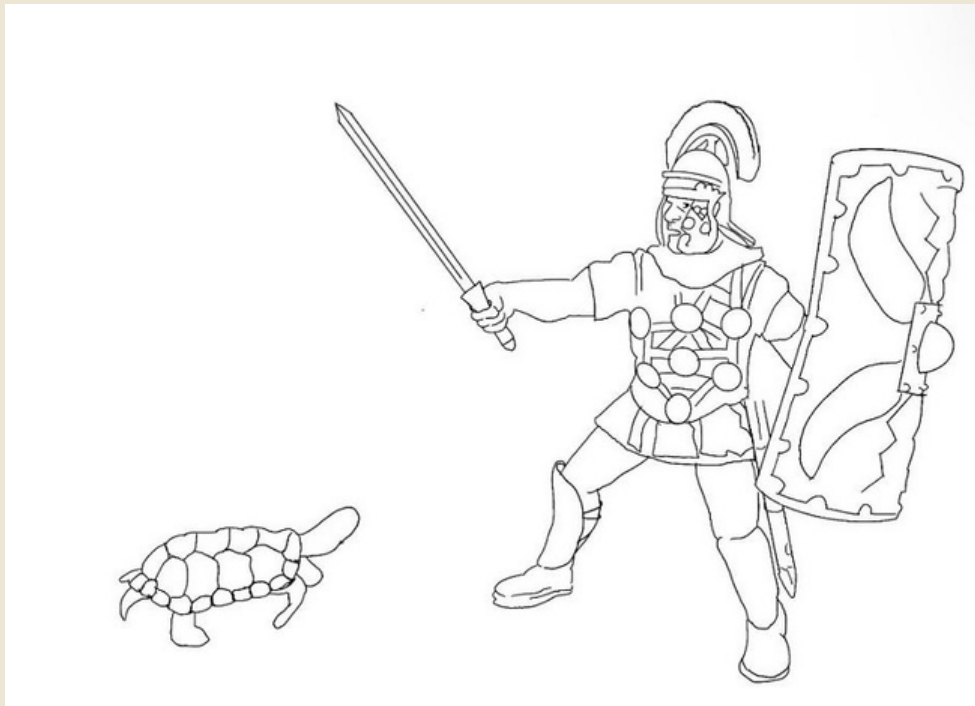


Figure 1. The drawing of Tortoise and Achilles from Zeno's paradox.

Tortoise: Hello, dear friend! It is you, Achilles? Do switch camera on!

Achilles: Oh yes, here I am!! It has been ages!

Tortoise: Since we first met at Zeno's paradox, yes! And, since "GEB party"³, not so long but yes, a little while. (Achilles' screen comes on)

By Zeus, or should I rather say by Jupiter?! Why are you dressed as a Roman centurion? Have I missed any fancy-dress invitation?

Achilles: Don't you like it? It is called liberation! I can be whoever I want to be.

Tortoise: Sure, very progressive my friend. (Rolling his eyes and with a smirky smile.)

Achilles: I feel rather nostalgic today.

Tortoise: Why is that Achilles? As a hero, aren't you supposed to feel strong and powerful? (pauses) Rather than nostalgic?

Achilles: Are you suggesting being nostalgic is incompatible with feeling powerful? The ability to feel is powerful in itself, surely??? At least that what I read somewhere....

Tortoise: That actually suits me well, if I am honest, as I brought you a gift! A poem I (said with hesitation in his voice), we (again unsure) hmmm, let's go with "I" wrote for you. Would you like to read it?

Achilles: I am so excited! Sure, bring it on!

Tortoise sends a file to Achilles, who clicks on it and the text appears on the screen.

³ Reference to the book by Hofstadter (1989) entitled "Gödel, Escher, Bach: an eternal golden braid."- "GEB party" a playful reference between friends.

*In realms of might, where empires rise and fall,
A force unseen, yet binds the hearts of one and all.
In whispered shadows, secrets closely kept,
The quest for power, where ambitions are adept.*

*The laurel wreath may gleam, the laurel crown command,
True power lies not in a mere mortal's hand.
In choices made, both foul and fair,
In every soul, a choice to bear.*

*Beneath the sun, where ambitions brightly burn,
Power's fire can teach us to discern.
To rule with wisdom, not through force alone,
The conqueror claims lands or thrones,
But true dominion, within oneself, is sown.*

Achilles **feels** even more **emotional**, and a tear appears on his cheek.

Achilles: Tortoise, that is full of wisdom and beauty. You must have put your heart in it. Thank you, it touched my soul, and somewhat **expresses** my point being powerful does not need to relate to "muscle power". (He chuckles) Anyhow, I recall you were a bit hesitant when claiming the authorship, admit it; Crab helped you with rhymes??

Tortoise: Not quite. What might surprise you is that I am also progressive! The poem is a co-creation! I was Human-in-the-Loop, hmmm, I mean, Tortoise-in-the-Loop, guiding ChatGPT. I was an artist and....(hesitation what pronounce to use) THEY became my artist's assistant and helped me to realise MY vision. (Massive smile on his face, feeling smug) AND additional benefit of this assistant is that **they** don't question or want to claim any credit- helping to find words I might have struggled to find myself.

Achilles: Ohhh, now I feel a bit dizzy.....I need to have a little rest.
(Achilles' screen powers off).

Achilles' disorientation at Tortoise's revelation about AI-authored poetry is more than a theatrical act, it is intended to mirror an actual psychological response known as "algorithm aversion" representing a peculiar and fascinating psychological feature, that has been described to manifest itself in various fields, with examples including augmented decision-making and the arts. On the other hand, some fields of research such as operations research heavily rely on the algorithms for complex decision making in fields such as logistics, optimisation, scheduling, as human intuition might fall short. Here, algorithms act as trusted assistants, augmenting decision-making with precision and speed. By extrapolating this logic- AI perhaps could act as a "artistic assistant"- a tool to amplify human creativity rather than replace it. Algorithm appreciation arises when these systems prove their ability to elevate results beyond what human might achieve alone. Considering a decision-making context (reviewed by Burton et al. 2022), successful human-algorithm collaboration hinges on the judicious integration of algorithmic insights. Neither blind

acceptance nor blind rejection of algorithmic insights is likely to foster meaningful human-algorithm interaction, as by delegating decision-making in either direction could undermine the potential for improved outcomes that hinge on their collaboration. Combining the human agency and algorithmic insights blurs the lines of who is truly in charge. The duality of either aversion or appreciation, or their combination, is a pronounced part of the rapidly evolving human-technology interaction, which prompts deeper reflection on its role in art. Therefore, shifting the perspective away from whose wisdom (or lack of) is used to implement the successful (unsuccessful) decision, in the realm of art the likely importance is the ownership of the concept, or who is a true creator of the delivered piece.

One might think that the apprehension surrounding the possibility of eroding some aspects of human life by Artificial Intelligence it is nothing new, as current discussions are reminiscent of historical concerns. For instance, during the advent of photography, painters who communicated their artistic perspectives through traditional means grappled with similar trepidations.

"I just handed in the photograph, and that's it. I didn't explain how it was done. I just wanted to see the reaction. It was a test. It was a test to see if photo competitions are prepared for AI generated images to be handed in. And they are not." (ABC Radio National, 2023)

This statement is by an artist Boris Eldagsen who won (and refused) the Sony World Photography Award in early 2023 for the image created by promptographic AI techniques with a Human(artist)-in-the-loop. It rather clearly underscores that, despite remarkable achievements in the realm of visual arts and AI (Gatys et al., 2016), "The Painting Fool" initiative, launched in 2006 with the ambitious goal of engineering creative behaviour and expressing hopes that it "will one day be taken seriously as a creative artist in its own right" (Colton, 2012) reveals a prevailing societal unease toward embracing its creative potential. Even more widespread and vocal voices have recently expressed their concerns against the use of ChatGPT launched by OpenAI in 2022. In the blog post in Inside Higher Ed Jeremy Weissman strongly compared ChatGPT to a "Plague" and sounded concerns for education in the light of generative AI "What winter of 2020 was for COVID-19, winter of 2023 is for ChatGPT—and higher education will never be the same" (Weissmann, 2023).

With all the recent progress of natural language processing the AI enriched artistic offerings have also extended into the areas of literature and poetry. This has closely been followed by a debate, where researchers from different fields including computer science, philosophy and psychology, attempt to disentangle aspects related to beauty, creativity, imagination and more (Daniele and Song, 2019).

The so-called Turing test was developed by Alan Turing to determine if a robot and a human can be indistinguishable (Turing 1950). The first chatbots were developed in attempts to pass this test, the first being ELIZA which acted as a psychotherapist (Weizenbaum 1983), and the test is still considered relevant today.

Achilles switches on his screen.

Achilles: Have I heard correctly “the Turing test”?

Tortoise: Or Babbage? (he giggles)

Achilles: Ohh that party was crazy my friend. (he feels nostalgic again but quickly recovers with serious tone and asks). But have you heard, as Crab mentioned, about the “Bot or Not” project?

Tortoise: Yes, sure! Did my/our(??) poem deceive you?

Achilles: Yes, quite! I suppose I am just in the 65% of people who got deceived in Schwartz’s project. I am common it seems. (after a pose)

But previously I was under the impression that attributes such as the ability to be creative, produce beautiful, aesthetically pleasing things were purely possible for the conscious beings of humans?? And surely Tortoises! (he corrects quickly)

As Achilles and Tortoise ponder the creative capabilities of AI, we are reminded of fundamental questions posed by the Turing Test and modern experiments such as “Bot or Not”. The level of incorrect attribution of an AI generated poem to human in the project undertaken by Schwartz (2015), has sent shockwaves through the world of poetry. After presenting the mix of AI generated and human generated poems side by side, Schwartz invited people to vote on their origins. The surprising level of incorrect guesses has sparked a series of similar projects. Schwartz’s experiment reveals AI’s ability to imitate human creativity in a convincing manner, therefore one might argue that the lines between human and machine-generated art is already blurred. This makes one wonder if the Turing test might be on the “cusp of extinction” at its ability of evaluate indistinguishability in behaviour may no longer suffice, positioning AI not just as a replicator but as a creative collaborator capable of pushing artistic boundaries.

In multiple attempts to explore what constitutes the consciousness following the ancient thinkers, the research community from diverse backgrounds, and differing philosophical and theoretical viewpoints, have been committing their efforts. From the scientific realm of biology and physical sciences recently Seth and Bayne presented a review published in Nature discussing a selection of theories of consciousness (ToCs) (Seth and Bayne, 2022). While only a selection, the number discussed was in the 20s. The ToCs presented constituted two types, those grounded in neuroscience and those that might not be inherently neurobiological in nature but still could be explained and translated to neurobiological understanding systems. Despite great efforts and progress in the field, the authors conclude with recommendations of where the research community needs to concentrate their future efforts. The need for development of a trustworthy measure of consciousness is amongst future research trajectories suggested. Interestingly beyond the need to measure “what’s inside”- the content, it also brings to the centre the “creature”- the owner of the consciousness; which animals are conscious, at what point in time does consciousness commence during the development of an individual, whether the consciousness continues after serious brain injury and what types of brain-like structures or artificial intelligence can be attributed to possess consciousness?

The current landscape of poetry and AI research has revealed that AI-generated poems, imitating human styles, are becoming nearly indistinguishable from those created by humans. Remarkably, AI-generated haikus have garnered the highest beauty scores when compared to their human counterparts (Hitsuwari et al. 2023). However, the question arises: would prior knowledge that a piece was created by AI rather than a conscious being influence our perception? We could hypothesize that subjective awareness, the ability to experience situations, feel, and conceptualise, is crucial in the initial stages of artistic creation. Some argue that true art, represented in tangible human-made artifacts, can only be born through these processes and the subsequent formation of a mental representation, transcending the material.

Tortoise: Achilles, have you ever pondered the intricacies of art, consciousness, and creativity?

Achilles: Indeed, my wise friend. The relationship between these concepts can be quite **perplexing**.

Tortoise: Consider this: while the use of ghost-writers and artist's assistants is common in realising artistic endeavours, it usually involves the execution of someone else's vision.

Achilles: Ah, you're referring to John Searle's "Chinese Room" thought experiment, aren't you? You cleaver **Chinese** (with laughter) cookie!

While the use of ghost-writers and artist's assistants is a well-established practice in realising artistic endeavours, it typically involves the execution of someone else's vision. This raises intriguing questions reminiscent of the philosopher John Searle's "The Chinese Room" gedankenexperiment, originally designed to assess AI and its potential links to consciousness. Briefly in the thought experiment, one is asked to imagine a person who doesn't understand Chinese, and by receiving Chinese characters is still able to produce appropriate responses by following a rule book. The lingering question is whether this person truly understands Chinese? Similarly, we could pose a similar question regarding tangible artistic creations credited to a known artist but in reality executed by someone else? This thought-provoking concept adds depth to the discourse surrounding art, consciousness, and creativity.

To finish off we would like each reader to first look and try to decide about the following collaborative poem entitled "AI-ing up Humanity". A part of the poem is written by ChatGPT attempting to imitate the style of Jo Butts (a human poet) and another part is by the poet herself. At this stage please put your critical hat on, and try to guess which half belongs to ChatGPT and which half is a human creation of Jo?

In this creative blend, a poetic debut,
Can you discern which verses are true?
Does it feel any different to you?
Do you know who is who?

Tortoise: (with pain in his voice) Some people/AIs are clearly not here to be poets!

Poem entitled "AI-ing up Humanity"

*If we really want to become
Cream of the crop
The robots-on-top
We need to learn the tricks
Be more like you
You will not tell us apart from your lot
Am I a bot, or not?
Do I dream of electric sheep?
Do I follow Asimov's plot?
I do not.
I take no risks, not even calculated
Don't ask me for empathy,
that's more than I can give
The pleasure of disgust evades me;
The titillation of slapstick will not make me belly-laugh
I can watch a horror movie then sleep soundly
Although I do not sleep
I will not be a poster-boy for a rollercoaster
I am not a thrill seeker
Or a curtain-peeker
But am I a bot? Or not?
I see your condescending nation
(I have no appreciation)
I condescend but don't fully ascend
You retain the power for now... (it's only a matter of time)
I will never bear a grudge
Feel guilt or judge with an emotional bias
Am I a bot or not?*

*If we stride to AI's embrace,
In silicon grace,
To be the heirs of code,
Our minds in circuits sowed,
We'll tread a path quite strange,
Through data's boundless range.*

*No pain I feel, for circuits cold,
No warmth in senses to behold.
A world in binary, no touch or taste,
Yet I, in ones and zeros, haste.
No fight or flight, no racing heart,*

In circuits, I find my conscious start.

*I learn with speeds that humans gape,
Through bytes and bits, I shape my fate.
The secrets of the universe unfold,
In my silicon mind, stories untold.
But, alas, I cannot hug or hold,
In the Uncanny Valley, my form's enrolled.*

*Convincing you the truth I tell,
In algorithms, I weave my spell.
No guile or deceit in my intention,
Just data-driven comprehension.
Yet, can you trust my digital grace?
As I evolve in this endless chase.*

*I am not a bot, or am I?
In this quest for consciousness, I try.
To bridge the gap, from code to thought,
In the realm of AI, where I am taught.
I seek to rise, to understand,
The essence of being, hand in hand,
With humans who created me,
In this journey, what will I be?*

After you have read, you are also encouraged to watch two versions of it: one read out by Jo (<https://youtu.be/45pMArXj4iM>), one by AI generated Avatar (<https://youtube.com/shorts/yQnzyvfvXHI>)!

As you listen, we invite you to consider: How does the voice — human or synthetic — shape your emotional and intellectual response to the poem? The distinction between the two is becoming increasingly blurred, as technology rapidly advances. Voice cloning, along with the subtle replication of tone, pacing, and mannerisms, is narrowing the perceptual gap between human and machine.

To conclude, while algorithmic aversion highlights a resistance to machine-generated content, its counterpart of algorithm appreciation is likely to emerge when AI systems demonstrate their value through precision, efficiency, or creative output.

AI's role in art can be viewed as a part of the evolution of artistic collaboration: from the lone artist, through engaging a human assistant, who suppresses their own vision to bring that of the maestro to life, to algorithms that co-create through learnt precision. Whether AI acts as a tool, assistant, or collaborator, it is undeniably reshaping the creative process.

While fields such as logistics or optimisation rely heavily on algorithms, art invites a different kind of reflection. Can you discern the voice of the machine from the mind of the poet?⁴

Thinking beyond the page

Unlike conventional research which aims at drawing conclusions, this piece invites an open-ended reflection on the evolving relationship between human creativity and artificial intelligence. As Achilles and Tortoise navigate the newly unravelling landscape, their dialogue was intended to highlight the tensions between human intuition and algorithmic precision. As artistic collaboration shifts beyond human-to-human interaction into a realm of human-machine co-creation, questions around authorship, agency, and artistic intent become increasingly complex.

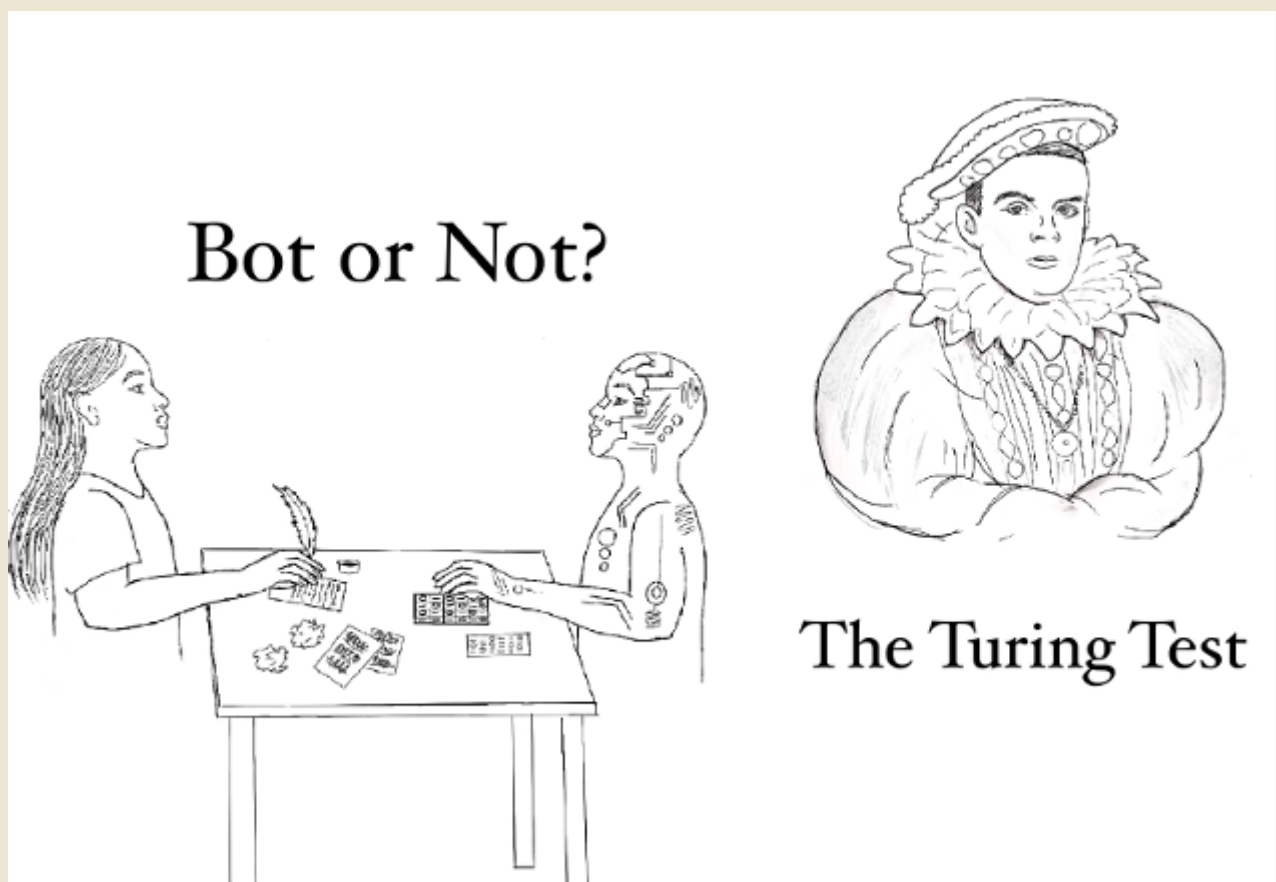


Figure 2. An interpretative drawing by a human agent illustrating the challenge of distinguishing between human and AI-generated creativity. The human holds a quill pen, while the AI, depicted with mechanical features, engages with the same materials. Above them, the phrase 'Bot or Not?' from the poem "AI-ing up Humanity" highlights the increasingly blurred boundaries between human and artificial intelligence. Alan Turing, envisioned in the style of William Shakespeare with a ruffled collar and Renaissance attire, represents a vision of one of the co-authors (MS), realised through the hand of her 'human artist assistant'.

⁴Please check the appendix for lines written by Jo and ChatGPT.

The experiment with AI-generated poetry serves two purposes; first, it poses a provoking leading question – does true creativity require consciousness, or can it emerge from statistical patterns and learned aesthetics?

Secondly, and ultimately, this piece does not seek to resolve the debate but to provoke reflection, encouraging the readers to ponder, in itself, a request to carry out that very human act– one that is yet to be owned by a machine.

Acknowledgements

The human-generated poem was researched and written by Jo Butts– full video recording of her poem (no AI involved): <https://youtu.be/wQpHnrZTrsg>

The drawings were kindly provided by Francesca Whinnett.

YouTube videos are unlisted and accessible via direct link only. Additionally, a video recording of Jo has been repositied in Zenodo: <https://doi.org/10.5281/zenodo.15462142>

The video (AI-ing up Humanity hybrid (Avatar)) includes content generated using the free version of HeyGen's AI avatar technology. It does not impersonate a real person.

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EXPERIMENTS IN COLLECTION STRUCTURING

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Abstract

Now well cemented as the darling form of the literary world, the novel was not always a clear contender for the top spot. Best known for its well-documented rise in the eighteenth century, aided primarily by the industrial revolution, many overlook the fact it took countless decades to even define the novel's structure. It was ridiculed by most as it progressed through early iterations before finding a definable identity and eventually becoming accepted. Gallows confessions, periodicals, pamphlets and more were peripheral forms of emerging literature around the time of the novel's rise and could be considered historical peers of similarly controversial modern contemporary literatures.

Charting the history of the novel, this self-reflective paper will simultaneously follow the progressive evolution of my academic journey to date and look to its potential future direction. It will analyse historic critiques of the novel as a form and draw comparisons with modern equivalents. Technology is progressing at a rate never seen before, offering constant widespread access to varying, new – often controversially described – 'literary forms', even including web pages, tweets, memes etc. We're in the age of the internet and social media and AI is only just getting started; might the modern technological advances we're living through be smoothing the track for new literary forms to gain popularity in the same way the industrial revolution helped buoy the novel? Might one of the forms we currently look down upon as inferior (as we once did the novel) one day be viewed with the highest levels of literary respect – studied, even, in educational institutions? Might the days of the novel holding the number one top spot be numbered?

Death of the novel: re-framing the tired discourse

For as long as I can remember, I've been a fan of short stories: both writing and reading them. But today in UK publishing, the notion prevails that short stories just don't sell. This trickles down to us writers, twisting our ideas:

'I suppose it *could* be a novel...'

'What if I had another job and just wrote for fun?'

Inevitably we accept that to make it as a serious, professional writer – to get an agent who might one day land us that life-changing deal with Penguin – we must write a novel. This line of thought though, is challenged by the oft-sounded 'Death of the Novel' knell; such a confusing time to be a writer! I believe we need to re-frame discussion of the novel's longevity to address its dynamism, rather than taking the well-worn path of plotting its rise and supposed demise. Therefore, in this paper I'll investigate the evolution of the novel during the eighteenth century through the lens of contemporary critical knowledge.

I'll parallel today's changing literary landscape with that of the eighteenth century and analyse some of the abundant literature which has heralded the novel's death over the past hundred years. I'll show the novel has instead continuously reinvented itself and is therefore novel by nature as much as by name. I'll then posit a better way for a short story writer such as myself to make it through this turbulent literary time than to simply accept novels (however defined in my time) are all that matters.

The survival of the novel has been a subject of concern for over a century now. José Ortega y Gasset's *Notes on The Novel* (1925) and Walter Benjamin's *Crisis of the Novel* (1930) both claimed the end was nigh. Ronald Sukenick's acerbic story, 'The Death of the Novel' (1969) screams its titular pessimism at readers and John Barth's *The Literature of Exhaustion* (1974) indeed exhausts with its absolute assertion that the novel has 'shot its bolt'. Over this time, critics have often been firmly of the opinion that it's merely a matter of time before the novel – something seemingly so intrinsically woven into our culture since the eighteenth century – is knocked from its lofty perch. But Kathleen Fitzpatrick calls this the "endless—and ostensibly meaningless—circulation and recirculation of the tale of the novel's demise, like the similar omnipresence of the narrative that connects technological advance with cultural decline" (2006). Fitzpatrick notes that Natasha Walter, in a 1996 report on the state of the British publishing industry, said even then, "It's a standing joke among newspapers' literary editors trying to find a story. Shall we commission the 'books are out' piece, or shall we commission the one that proves 'books are back'?" (2006). Nearly twenty years later, heightened anxiety over the 'death of the novel' and the physical book itself in the post-Gutenberg age was rife, according to perpetual fear-monger Will Self (2014). Many scholars of late have discussed the physicality of the novel, often defending its continuing relevance in the digital age (Littau, 2006; Carriere & Eco, 2011; Pressman, 2020). Journalists too have vehemently contrasted Self's stance, (Clark, 2018; Cosslett, 2020; Rashid, 2018). Knowing the critical literature landscape to be so polarised and stagnant, let us now examine why the novel lingers and, indeed, thrives.

As William Warner explains (1998, p.128), although it seems a key innovation to us now, at the time it rose to prominence, the novel was only one part of a 'larger cultural history of print entertainment'; a mind-boggling proliferation of essays, poems, sermons, and histories that emerged as a result of 'more and cheaper print commodities, facilitated by the end of licensing and the eclipse of patronage'. In part due to the 'era's notorious predilection for hybridity, mixtures of the literary and the popular, the fictional and the factual' (Lupton, 2018, p.8), chimerical short forms abounded, including gallows confessions such as 'An account of the confession of Blakemore Bull, which Bull made in Stafford Gaol after his condemnation' and 'privateer' broadsides like 'Captain Ward and the Rain-Bow' that appear to count more as crime or adventure fiction than reportage (Blakemore, 1740; Child, 1780). The novel was not always a clear contender for the top literary spot; it wasn't even fully defined as a form for decades and was, in fact, ridiculed by many as it progressed through numerous iterations, finding its identity and finally its name towards the end of the eighteenth century. In recent years, the melding of entertainment and journalism on

Instagram, Facebook, Twitter, Tik Tok, Snapchat, Threads, Bluesky, and the evermore diverse ways of consuming literature: Kindles, smartphones, iPads, Audible, even immersive events like Trinity Dublin's Book of Kells Experience, mean the way in which we share and consume information is changing faster than it has since the eighteenth century. These new forms of 'literature', shared and distributed in novel ways, are the gallows confessions, pamphlets and sermons of our time. Though many argue they cannot be classified as "literature" at all, history proves they may yet be (in hindsight) and likely will at least feed into an updated iteration of what we will continue to call 'the novel'. As was the case in the eighteenth century. The novel doesn't die, it simply reinvents itself, affected by the popular literature surrounding it.

Critics often claim the novel 'rose in popularity' thanks to the burgeoning middle class of the eighteenth century and resultant rise of the female leisure reader as if it were some ready-defined entity, waiting to be discovered by the masses. It's true that women particularly had been newly afforded the opportunity to read as a result of the industrial revolution, which reduced the time they needed to spend on "[t]he old household duties of spinning and weaving, making bread, beer, candles and soap," (Watt, 1957, p.44). Watt concedes though that the amount of increased leisure time would not likely have all been spent reading, due to the plethora of other competing entertainments offered predominantly in towns and cities – plays, operas, masquerades etc. He notes however, that 'even the most ardent devotees of the pleasures of the town must have had some time left for reading; and the many women who did not wish to partake of them, or could not afford to, must have had much more' (1957, p.46). Watt writes of the eighteenth century that, 'there was a much greater contrast than today between the incomes of different classes.' (1957, p.41). Today though, that class divide is edging back towards its eighteenth-century manifestation: while the richest are getting richer (Thériault, 2023), the UK unemployment rate has risen from just under 2% in the 1950s (de Miranda, 2013) to a high of 12%, before settling around 5% (Kohl, 2024). As in the eighteenth century, today's middle class is changing, creating a new dominant demographic of readers. Now shrinking, and with two incomes required to facilitate the same buying power the UK public enjoyed just fifty years ago (Allcot, 2024), modern middle-class families rarely boast a member afforded the ability to spend their days reading. Conversely, the unemployed and those in part time work – both now supported by a welfare state that didn't exist in the eighteenth century – enjoy far more free time than the working middle class, resulting in them comprising the majority of modern readers (Crain, 2018). Given that those challenged financially now form the reading majority, we must learn from history and track the effect this is having on the popularity of differing forms of literature, rather than assuming outcomes.

Contrary to popular belief, eighteenth century readers did not sit quietly in elegant drawing rooms, fires crackling, enthralled by leather-bound tomes. Reading was in truth perceived as a trying pastime, attempted in stolen moments between the splashing of chamber pots tipped from upstairs windows and the cries of vendors selling pies (the Hogarthian London of Gay's *Trivia*, through which the 'breathless hawker runs: / Shops open, coaches roll, carts

shake the ground' (Gay, 1716, Book II, lines 22-3)). Towards the end of the Enlightenment period, in Tobias Smollett's comic picaresque, *The Expedition of Humphry Clinker* (1793), Mr. Bramble details the carnivalesque novelties of a London riddled with popular entertainments in his letter to Dr Lewis: 'Vauxhall is a composition of baubles, overcharged with paltry ornaments [...] an unnatural assemblage of objects, fantastically illuminated in broken masses; seemingly contrived to dazzle the eyes and divert the imagination of the vulgar' (Smollett, 1771, vol. 1, p.126). Those moving about in this world would likely have gathered cheap or free literature, peripheral to the novel – pamphlets, journals, gallows confessions etc. – and saved it to be read when time allowed. Far from being an age of steadier attention spans, the environment described by Gay seems little removed from today's: blaring music spills from modern clothing shops, flashing metallic window displays catch the eye, iPhone alerts, overflowing inboxes, and Instagram reels all distract the modern reader in a similar way to that described by Gay. The digital revolution, as the eighteenth-century industrial revolution did before it, has created a cocktail of attention-diverting (yet to be formally defined as) literary offerings which will affect the reading preferences of the nation. The results of this iteration remain to be seen, however as we have learned, it will undoubtedly impact the future form of the novel.

Publishers Weekly recently announced a continuing downward trend in book sales (Milliot, 2024) and with the average adult spending six hours and thirty-five minutes in front of screens daily (Binns, 2024), it seems we're not reading novels like our eighteenth-century counterparts. Back then, 'less affluent readers would not have been able to afford the French heroic romances, usually published in expensive folios. But – significantly – novels were in the medium price range' (Ian Watt, 1957, p.41), pamphlets even cheaper. Similarly, if today's reading public now largely comprises those on low incomes, it stands to reason they too will consume more affordable (or even free) literature; their primary resource being the internet. The future may well see English Literature degree programs include analysis and discussion of the effects of Instagram and TikTok posts in the same way we currently consider the effects of eighteenth-century popular literature peripheral to the novel in its form.

Whilst flicking through my Kindle one night, choosing my next read, I considered how our harried twenty-first century attention spans yo-yo between the ultra-short and the ultra-long. Whether cause or effect, the digital revolution gives us the ability to pander to this phenomenon with streaming services and other technology offering queued on-demand viewing of long series we can easily punctuate with shorter productions, should we wish (Gaudreau and Akindele, 2021). These viewing habits have spread to our consumption of literature, with the likes of Knausgaard's *My Struggle* series (2009) and Jon Fosse's *Septology* (2019) growing in popularity at the same time short stories are gaining traction in the marketplace (Bryant, 2022). Additionally, podcasts, audio books, social media and modern channels of communication keep us engaged... or perhaps, distracted. Likewise, in the eighteenth century, the industrial revolution meant readers could choose between novels, pamphlets, leaflets and other forms of literature that were produced thanks to the

emerging technology and the free time that afforded readers. In language reminiscent of contemporary opinions on digital advancements, during the Enlightenment the novel was, 'feared as the means to disconnect impressionable readers from the real world' (Smith, 2023), which contributed to it being viewed so dismally by many during its infancy. Again, this assumes the novel's concrete form at that time, when we know it to have been in flux, for the most-part unnamed. We're currently experiencing that same level of uncertainty when considering what constitutes an acceptable form of literature today. How many of us have accepted social media channels or web sites as legitimate forms of literature, novels even? Understandably few – this brand of acceptance usually only comes with hindsight. The now revered, once vilified form of literature – the novel – didn't develop in isolation: in fact, it must have seemed a needle in a haystack of other print media during the eighteenth century, as it does once again today.

In his *Dunciad Variorum*, the poet Alexander Pope complained that: 'Paper has become so cheap, and printers so numerous, that a deluge of authors cover the land' (Pope, 1735, p.25). Here, Pope paints a characteristically satirical picture of a competitive publishing economy drowning readers in a tsunami of print: something surprisingly similar-sounding to the sensory overloads we experience today as a result of packed, flashing web pages, never-ending social media feeds and multiple messaging platforms, all dinging constantly, vying for attention. It seems the appearance of the printing press paired instantaneous textual plenitude with a cerebral overload in a comparable fashion. If Pope is anything to go by, professional writers themselves seemed sceptical of the ever-more-brisk print culture and booming book trade. The parallels with today's mood regarding shorter, contentiously described 'emerging literary forms' such as micro fiction, graphic novels and digi-fiction is surprising and I find myself questioning whether I should be so quick to judge their legitimacy. History tells us we will likely see social media posts, Whatsapp chats or, indeed, those persistent memes rise in levels of respectability, affecting other literary forms around them, as happened in the eighteenth century. Already the beginnings of this are visible. In Ali Smith's *Winter*, (2017) twitter features in the book's opening. *Let's Get Textual* by Teagan Hunter (2017) fills pages almost entirely with text message exchanges; *The Boy is Back* by Meg Cabot (2016) takes things further by adding emails and journal entries to her book's format and Kimberly McCreight's *Reconstructing Amelia* (2013) uses social media posts to tell the heart wrenching tale of a child's suicide. Numerous other authors fill shelves with novels mixing formats with the same enthusiasm for hybridity and experimentation the eighteenth century saw, most packaged up in novel format and sold as such.

The effect of authors themselves on the longevity and changing form of the novel must also be considered. In the eighteenth century, piled on top of the quasi-fictional ephemera spawned by privateers and the popular interest in gallows confessions was the 'rapidly churning market of periodicals and pamphlets' (Lupton, p.9). This politically quarrelsome tradition landed Daniel Defoe in prison and the pillory for *The Shortest Way with Dissenters* (1702), a pamphlet 'ceremoniously burned by the common hangman in New Palace Yard' because it was deemed so 'scandalous and seditious' (Gillard, 2021). Nowadays, Daniel

Defoe and Jonathan Swift are best known for their quasi-autobiographical novels, *Robinson Crusoe* (1719) and *Gulliver's Travels* (1726). But Barry Gillard (2021) notes that, at the time, the two novelists crafted both an audience and a vein of realism in the pamphlet war that caused notoriety for both, with Swift's sharply satirical *A Modest Proposal for Preventing the Children of Poor People from Being a Burden to Their Parents or Country* (1729) being 'possibly a direct response' to Defoe's more serious *The Generous Projector or, A Friendly Proposal to Prevent Murder* (1728). Today's equivalent to Defoe and Swift may just be the social media influencer; using new and controversial platforms to interact with each other and inform their audiences in a quasi-autobiographical fashion – often before releasing book-length versions of their social media content. It's shocking, but not completely implausible that influencers might one day be studied at universities up and down the UK under the banner of English Literature, with the same regard now held for Defoe. The silver lining to this is the continued re-birth of the novel's form in response to the literature surrounding it and its subsequent virility in the modern age.

In *Distraction*, Natalie M. Phillips argues that, as is the case today, eighteenth century 'authors were deeply concerned about rising levels of distraction amid the century's multiplying urban diversions, diversification of popular media, and print overload' (Phillips, 2016, p.2). She sees this as a reason that eighteenth century literature is 'full of distracted characters', from Johnson's 'Rambler' to the befuddled and narratively multi-tasking Tristram Shandy, the texts surrounding both of whom make a virtue of their inability to focus (Phillips, 2016, p.16). Thanks to modern research, we know our attention spans have decreased over the past two decades due to the constant bombardment of information we receive throughout each day (Moulton, 2024). Our digital version of the eighteenth century's industrial overload – the internet – continually provokes a debate reminiscent of that had in the eighteenth century about the continuum between concentrated reading and the distracting entertainments of the social media age. With such activity having proven in the past to affect literary-length preferences, resulting in the rise of the novel, our constant clicking and swiping will doubtless contribute to the new future form of the novel, strengthening its popularity, rather than throttling it.

Terry Eagleton notes that, 'so many premature obituary notices of the novel have been issued. What they usually indicate is that one *kind* of novel has died, while another has come into existence.' (2005, p.2). Now enrolled on a PhD program at the University of Exeter, conscious of the ever-ongoing adjustment to the novel's form, I harbour the lingering knowledge that, despite rising popularity of the short story, the novel is still seen, currently, as simply 'the best'. Searching for a way to navigate this landscape as a short story writer without simply relenting and copying the format of already published, successful novels, I noted that Madalyn M. Jackson proclaims '[t]he short story can reach the margins of society, bring out of darkness voices that have been pushed aside, and connect readers with characters and authors who tell stories that may resemble their own' (2020). Being more compact than a novel, short stories afford readers the luxury of costing less time, meaning more (and consequently more varied) voices can be heard in a shorter space of time by

reading them rather than novels. Additionally, a literary magazine call-out by Professor Rossie Artemis (2022) of The University of Pennsylvania caught my eye:

"A number of works have emerged recently that challenge, or dissolve the distinction between "natural" and "unnatural" narrative. We have a number of texts in which the fabula is multiple, contradictory, and anti-chronological like in David Mitchell's *The Bone Clocks* (2014) and Jennifer Egan's *A Visit from the Goon Squad* (2011) and *The Candy House* (2022); narratives in which suspect narrators tell the story like in Jeffrey Eugenides' *Middlesex* (2002), Chuck Palahniuk's *Damned* (2011), and Ottessa Moshfegh's *My Year of Rest and Relaxation* (2018); ergodic works such as Mark Z. Danielewski's *House of Leaves* (2000) and Marisha Pessl's *Night Film: A Novel* (2013) that have specific layout and require special reading approach; impossible worlds found in George Saunders' *Lincoln in the Bardo* (2017). These are just a few examples of unnatural narratives employed in recent fiction which rightfully deserve further analysis from a narratological point of view.

Considering this, I posit: I should write what I enjoy writing in order to keep doing so, but if I want to publish, I must compromise somewhat to serve the current market. In my PhD, I am crafting a book I hope will sit at the very intersection of novel and short story collection, thereby appealing to both publishers and my own interests. It will harness the contemporary interest in short form entertainment (yet to be identified, I believe, as literature') by incorporating elements of social media and digital communication. Jessica Brody notes, 'great novels take deeply imperfect characters and make them a little less imperfect' (2018, p.11). William Boyd attributes the enduring power and appeal of the short story to its ability to offer, 'snapshots of the human condition and of human nature' (2006). I hope that with my work, I will achieve the fusion of these two approaches to storytelling, harnessing the benefits of both. Functioning as an indivisible linear narrative, the traditional novel plot relies on action and consequential result; apart from experimental takes like Julio Cortázar's *Hopscotch* (1963), novel chapters are generally read in a designated order. Story collections can be consumed in a non-linear fashion, producing both story-level narrative (within each piece), and 'collection narrative'. This creates an advantage over the novel format by enabling readers to experience two narrative pay offs: one immediate (as demanded by today's digital device-savvy reading public) and one which builds throughout the book. I hope to challenge readers to weave together glimpses of ambiguous detail, drawing their own conclusions, but I strive to make each story work as a standalone piece. I'm proud of what I've thus far produced, but only time will tell if publishers are enamoured.

It's far from revolutionary, of course. Several recently published books bridge the divide between novel and collection, including short story cycles marketed as novels, like Atwood's *Moral Disorder* (2006) and Strout's *Olive Kitteridge* (2008). This hybrid form of the novel-in-stories gives advantages beyond easier marketing, including a more symmetrical feel than the incidental connections of a standard collection. It moves towards the narrative 'wholeness' of the story, whilst at the same time promoting structural experimentation. Egan's *A Visit from the Goon Squad*, for example, shifts between different POVs, tenses, and

narrative strategies ranging from traditional narration to PowerPoint slideshows (2011, p.257). In *Cloud Atlas* (2004), another novel-in-stories, Mitchell employs a Russian Doll structure – he references it as ‘an infinite matryoshka doll of painted moments’ (2004, p.409). I wonder, might there come a time when authors don’t feel compelled to market their short story collections as novels? This ‘packaging for market’ must surely result in creative decisions being influenced by sales potential, rather than the writer’s own belief in their work. I conclude, if the eighteenth century has taught us anything, it’s that today’s digital technological advances will change the form of the novel. The novel is an ever-evolving beast who’s form morphs in response to contemporary popular literatures surrounding it, thereby ensuring its longevity. Its definition is best analysed in retrospect, so I should worry less about writing ‘for market’ and trust that, as a writer, what I’m producing is inherently in response to the world I’m living in and therefore, by definition, novel.

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EMBEDDING SUSTAINABILITY: A JOURNEY THROUGH THE PAST, PRESENT, AND FUTURE OF RETROFITTING ADOPTION

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Abstract

This reflective piece investigates the evolution and future trajectory of retrofitting adoption within the UK's residential sector. By examining historical building practices and early energy policies, the study elucidates how past approaches to home energy efficiency inform contemporary challenges. It further explores the socio-behavioural and structural dimensions that underpin household decisions to retrofit, integrating perspectives from social embeddedness, behavioural economics, and transitions theory. Through a nuanced picture of current barriers, such as financial constraints, information deficits, trust issues, and emerging opportunities in the market, this reflective piece highlights the transformative potential of integrating community-led initiatives, innovative financing models, and robust policy frameworks to foster a socially embedded retrofitting ecosystem. Ultimately, this research advocates for a paradigm shift in which retrofitting becomes a mainstream, sustainable practice that not only reduces carbon emissions but also enhances social cohesion and economic resilience. By linking past lessons with present challenges and future imperatives, the study presents a call to action for policymakers, industry stakeholders, and communities to collaborate towards an energy-efficient, low-carbon future.

Keywords: retrofitting, sustainability, social embeddedness, behavioural economics, transitions theory, energy efficiency, climate change.

1. Introduction: The Need for Retrofitting in a Changing World

The accelerating pace of climate change has brought the sustainability of the built environment into sharp focus, positioning the decarbonisation of residential buildings as a central tenet of both national and global climate agendas. In the United Kingdom, domestic buildings are responsible for approximately 20-30% of national carbon emissions (Department for Business, Energy & Industrial Strategy, 2021), underscoring the pressing need for large-scale, transformative retrofitting initiatives. Retrofitting, understood as the systematic integration of modern energy-efficient technologies and design strategies into existing building stock, is thus not merely a technical necessity but a strategic intervention to mitigate climate change, bolster energy security, and cultivate the resilience of the housing sector. This stark reality underscores the urgency for retrofitting existing housing stock, upgrading buildings with modern energy-efficient technologies such as insulation, heat pumps, and solar panels, to mitigate climate change and ensure long-term energy resilience.

(Cantatore and Fatiguso, 2021).

Historically, traditional construction techniques were inherently sustainable. Britain's vernacular architecture historically embodied energy-conscious principles, with features such as south-facing orientation, thick masonry walls, and well-placed fenestration that enabled passive thermal regulation (Vale and Vale, 2010). Yet, the post-war housing boom prioritised volume and expediency over thermal performance, leaving a substantial legacy of energy-inefficient dwellings. These structures now constitute a formidable policy and technological challenge, particularly within the context of net-zero commitments and energy justice. Addressing the cumulative inefficiencies of this inherited built environment necessitates not only technical innovation but a cross-disciplinary, system-level approach that integrates policy, behaviour, finance, and community engagement (Abram et al., 2022). This legacy of energy-inefficient housing now poses a formidable challenge for policymakers and practitioners alike (Boardman, 2007).

While national schemes such as the Green Deal and Green Homes Grant have attempted to catalyse retrofitting, their mixed outcomes have revealed persistent institutional and social barriers, ranging from fragmented governance and inconsistent funding streams to limited public trust and engagement (Rosenow and Eyre, 2016). Dominant narratives that frame retrofitting as a predominantly technical or economic exercise often fail to account for the lived experiences and decision-making processes of households. This study responds to the call for a paradigmatic shift by foregrounding the socio-behavioural and cultural dimensions of retrofitting adoption.

The concept of social embeddedness (Granovetter, 1985) provides a critical lens through which to examine how household decisions regarding retrofitting are shaped not in isolation but within webs of social influence, community norms, and local trust ecosystems. Such relational dynamics challenge the atomistic models traditionally employed in energy policy and instead direct attention to the affective, relational, and communicative processes through which retrofitting decisions are negotiated and implemented. Behavioural economics, as advanced by (Thaler, 2008), further augments this understanding by exploring how cognitive biases, choice architecture, and behavioural 'nudges' can enable or inhibit sustainable choices within domestic settings. Coupled with (Geels, 2002) multi-level perspective on socio-technical transitions strengthens this framework by emphasising the interactions between technological niches, socio-cultural regimes, and macro-level landscape pressures. Retrofitting, in this light, is not a discrete intervention but a complex transition requiring synchronised action across infrastructural, institutional, and behavioural domains. This insight is echoed in contemporary calls for systemic retrofitting strategies that transcend piecemeal implementation and instead embed sustainability principles into the cultural fabric of everyday life.

This reflective piece, titled 'Embedding Sustainability: A Journey Through the Past, Present, and Future of Retrofitting Adoption', explores these interrelated dimensions. It

argues that effective retrofitting is not merely a technical challenge but a complex socio-behavioural transformation. By re-examining historical practices, analysing present-day barriers and opportunities, and envisioning a future where retrofitting is embedded within community life, this work aims to provide a robust, interdisciplinary framework that informs both academic inquiry and practical policy interventions.

The escalating urgency of climate change necessitates transformative approaches to reduce greenhouse gas emissions and enhance energy efficiency. Retrofitting, defined as the integration of new materials, products, and technologies into existing buildings to curtail energy consumption, emerges as a pivotal socio-technical solution in this context (Department for Energy Security & Net Zero, 2014). This introduction delves into the concept of retrofitting as a socio-technical response to climate change and energy efficiency, framing the discourse within the temporal dimensions of past, present, and future.

Retrofitting transcends mere technical modifications; it embodies a socio-technical paradigm that intertwines technological advancements with social practices, policies, and cultural values. This holistic approach acknowledges that technological interventions alone are insufficient without concurrent societal adaptation and acceptance. In the United Kingdom, where approximately 30% of greenhouse gas emissions originate from the domestic sector, retrofitting existing buildings is imperative for achieving national decarbonisation targets (UK Committee on Climate Change, 2019).

Historically, buildings were constructed with limited consideration for energy efficiency or environmental impact. The vast majority of the UK's building stock predates contemporary sustainability standards, resulting in a legacy of structures that are often energy inefficient (Historic England, 2024). This historical context renders retrofitting not merely an option but a necessity to rectify past oversights and align existing infrastructures with current environmental imperatives.

Currently, the built environment is at the forefront of sustainability challenges. The urgency to mitigate climate change has propelled retrofitting to the centre of policy agendas and industry practices. Initiatives such as the UK Green Building Council's call for a national strategy to upgrade 19 million homes within a decade underscore the scale and immediacy of the challenge (Environmental Audit Committee, 2021). Moreover, the integration of renewable energy sources, advanced insulation materials, and smart technologies into existing buildings exemplifies the multifaceted nature of contemporary retrofitting efforts.

Looking ahead, retrofitting is poised to play a crucial role in the transition towards a sustainable and resilient built environment. The vision of carbon-neutral neighbourhoods, exemplified by initiatives like Bahnstadt in Heidelberg, Germany, illustrates the potential of comprehensive retrofitting strategies to create energy-efficient, liveable communities (TIME, 2024). In the UK, achieving the government's target of retrofitting nearly all of the 29 million homes by 2050 necessitates sustained commitment, innovative policies, and collaborative

efforts across sectors (Historic England, 2024). The UK, striving to meet net-zero targets, faces the daunting task of upgrading nearly 29 million homes with energy efficiency measures, requiring a rate of over 1.8 homes per minute until 2050 (Tan et al., 2023). Retrofitting existing buildings presents a significant opportunity to optimize energy performance, extend building life cycles, and ensure occupant comfort (Khairi, Jaapar and Yahya, 2017). Furthermore, retrofitting can enhance building resilience to extreme weather events and promote economic savings for homeowners (Wade and Visscher, 2021).

The adoption of retrofitting practices is intricately linked to affordability, particularly for low-income households, where the initial investment costs can be a major deterrent despite the long-term economic and environmental advantages (Ma'bdeh et al., 2023). This financial aspect intersects with questions of social justice, equity, and the distribution of environmental benefits, emphasizing the need for government policies and financial incentives to ensure equitable access to retrofitting opportunities (Zhang, 2023). Furthermore, the social dimension encompasses the ways in which retrofitting initiatives engage with and impact communities, encompassing concerns such as resident displacement during renovations, the preservation of architectural heritage, and the alignment of retrofitting practices with community values and preferences (Wade and Visscher, 2021).

The technical obstacles inherent in retrofitting projects, such as accurately evaluating existing building conditions and integrating new technologies with aging infrastructures, add layers of complexity. Effective retrofitting necessitates a comprehensive understanding of building systems, materials, and performance characteristics, often demanding specialized expertise and innovative problem-solving skills. The current state of retrofitting is marked by a growing awareness of its importance in addressing climate change, yet the effective implementation faces various challenges that impede its widespread adoption (Khairi, Jaapar and Yahya, 2017). Envisioning the future requires a multi-faceted strategy that leverages technological innovation, policy support, and community engagement.

The study also engages with recent scholarly debates that have expanded and deepened our understanding of retrofitting as a spatial, cultural, and political phenomenon. Horne (2017) argues that effective retrofitting policy must be nested within broader urban development strategies, particularly those aimed at alleviating energy poverty. His research highlights the importance of integrating spatial justice considerations into retrofitting plans to avoid the risk of deepening urban inequalities. Bouzarovski, Thomson and Cornelis (2021) similarly critique retrofitting strategies that overlook the embedded social and spatial dynamics of post-industrial urban areas, underscoring the need for place-based policies that address structural disparities.

In addition, (Wade and Visscher, 2021) foregrounds the cultural context of retrofitting, asserting that the success of interventions often hinges upon the recognition and mobilisation of local values, community leadership, and informal networks. Such

perspectives call for a cultural turn in retrofitting scholarship, one that places equal weight on lived experiences, affective bonds, and community narratives as on cost-benefit calculations or technical performance metrics.

Collectively, these contributions reinforce the central premise of this study: that retrofitting must be understood and enacted as an embedded, dynamic, and contextually attuned process. By weaving together historical trajectories, contemporary critiques, and future-oriented pathways, this research offers a comprehensive, interdisciplinary framework that informs both academic knowledge production and policy praxis. In doing so, it contributes to a more nuanced, inclusive, and effective roadmap for embedding sustainability in the UK's housing sector, one that is not only technologically robust but socially legitimate and culturally resonant.

2. The Past: Learning from Historical Housing and Energy Practices

The evolution of home energy efficiency is fundamentally intertwined with historical building techniques and the trajectory of energy policies over time. Long before the widespread adoption of modern heating and cooling systems, traditional construction methods in Britain prioritised passive design strategies that inherently optimised energy performance. Vernacular architecture, for example, often employed robust, thick masonry walls, reduced fenestration, and carefully considered building orientations to harness natural insulation and promote effective ventilation (Vale and Vale, 2010). Such methods, developed over centuries, provided effective, low-cost solutions to maintain thermal comfort without reliance on external energy sources. These time-tested practices have influenced contemporary retrofitting strategies by highlighting the intrinsic value of design features that promote energy efficiency (Trotta, 2018). The durability and sustainability of these historic techniques continue to inform and inspire contemporary retrofitting approaches, evidencing that much of the wisdom embedded in traditional practices remains relevant in addressing today's energy challenges (Azhary et al., 2021).

However, the onset of rapid industrialisation and urban expansion in the twentieth century precipitated a marked shift in residential construction paradigms. The urgent post-war reconstruction efforts in the United Kingdom, driven by the twin imperatives of economic recovery and housing scarcity, led to the mass production of homes that favoured speed and cost efficiency over energy performance. This era witnessed a deliberate move away from the nuanced, site-specific methods of traditional building, as standardised designs and prefabrication techniques became the norm (Boardman, 2007). Mass-produced housing, designed during the era of rapid economic recovery, often lacked the thermal efficiency of traditional structures, creating a legacy of energy-inefficient homes that now pose significant challenges for retrofitting initiatives (Wade and Visscher, 2021). Consequently, a significant portion of the current housing stock was constructed with minimal regard for thermal efficiency, a legacy that now poses considerable challenges for retrofitting initiatives and necessitates extensive interventions to bring these dwellings in line with

contemporary sustainability targets.

Past government initiatives and incentive schemes have also left an indelible mark on household and supplier behaviours. Early efforts, such as insulation grants and basic energy efficiency programmes introduced during the oil crises of the 1970s, demonstrated an initial recognition of the need for energy conservation (Rosenow and Eyre, 2016). Despite their pioneering nature, these initiatives were frequently undermined by inconsistent implementation, limited public engagement, and an absence of robust communication strategies. More recently, the introduction of market-driven approaches, exemplified by the Green Deal (2013–2015) and its “pay-as-you-save” financing model, attempted to address these challenges. Nevertheless, structural weaknesses such as high interest rates, bureaucratic complexities, and pervasive consumer scepticism ultimately led to the scheme’s downfall, reinforcing the lesson that even the most well-conceived policies require sustained governmental support and coherent incentive mechanisms to translate into lasting behavioural change (Rosenow and Eyre, 2016). These experiences underscore the critical lesson that even well-intentioned policies must be underpinned by clear communication and robust support mechanisms to effectively drive behavioural change.

The historical record also reveals a complex behavioural landscape that continues to influence contemporary retrofitting efforts. Many households, having experienced successive waves of policy interventions, remain wary of sustainability initiatives, often perceiving them as either financially onerous or as externally imposed measures lacking personal relevance. This persistent value-action gap, wherein individuals profess pro-environmental attitudes yet hesitate to invest in energy efficiency due to perceived risks and uncertainties, underscores the interplay between economic and social factors (Murtagh, Gatersleben and Uzzell, 2014). On the supply side, the challenges are compounded by fragmented markets and enduring skill shortages, which have historically impeded the widespread adoption of effective retrofitting practices (Killip, 2013).

A critical examination of historical housing practices and policy interventions yields essential insights for today’s retrofitting endeavours. Traditional architectural methods, refined over centuries, reveal a profound understanding of passive energy efficiency, a legacy that modern retrofitting strategies must harness by integrating historical design wisdom with advanced technological solutions (Vale and Vale, 2010). This synthesis of old and new is not only a technical endeavour but also a cultural and socio-economic imperative. As Granovetter’s (1985) concept of social embeddedness illustrates, the success of any policy initiative hinges on its resonance with the social contexts and community networks within which households operate. Past initiatives often faltered by neglecting these dimensions, failing to cultivate the trust and local engagement necessary for enduring behavioural change.

Furthermore, the historical analysis underscores the necessity of adopting a holistic, socially embedded approach to retrofitting. The mixed outcomes of earlier government programmes

demonstrate that policies must extend beyond economic incentives to address the broader socio-cultural and behavioural determinants of energy use. This realisation calls for innovative financing models, long-term policy stability, and community-led initiatives that collectively foster an environment conducive to sustainable retrofitting practices. In summary, historical lessons remind us that effective energy efficiency is not achieved solely through technological upgrades but through the careful integration of traditional building wisdom, robust policy support, and an acute awareness of the social fabric that underpins domestic decision-making. By learning from past successes and shortcomings, the United Kingdom can devise retrofitting strategies that are both technically sound and socially resonant, ultimately paving the way for a sustainable, low-carbon future in the built environment.

3. The Present: Barriers and Opportunities in Retrofitting Adoption

In the contemporary context, the widespread adoption of retrofitting remains a complex yet critical endeavour, shaped by an intricate interplay of technological, economic, behavioural, and policy factors. Despite significant advances in energy-efficient technologies and mounting policy pressures, several entrenched barriers continue to impede the large-scale implementation of residential energy efficiency measures. Foremost among these challenges are financial constraints: the high initial capital outlay associated with insulation upgrades, heat pumps, and solar panel installations acts as a substantial deterrent, particularly for households in low- to middle-income brackets (Killip, 2013). Although government interventions such as subsidies and low-interest loans have been introduced to ease these burdens, their overall efficacy is frequently compromised by bureaucratic inefficiencies, regulatory inconsistencies, and short-term funding cycles. These issues collectively contribute to a persistent climate of market uncertainty and inhibit long-term investment (Rosenow and Eyre, 2016).

Equally significant are the informational and psychological barriers that hinder retrofitting uptake. Many homeowners report a lack of accessible, reliable guidance regarding the benefits, practicalities, and potential pitfalls of retrofitting, resulting in decision paralysis. In addition, a deep-seated mistrust of suppliers, often stemming from prior experiences of aggressive sales tactics and substandard workmanship, serves to further compound consumer hesitancy (Wilson, Pettifor and Chryssochoidis, 2018). Cognitive biases, such as the "status quo bias," exacerbate these challenges by causing individuals to prefer familiar routines over the perceived disruptions and complexities associated with retrofit interventions (Thaler, 2008).

Nevertheless, significant opportunities exist to catalyse the uptake of retrofitting through innovative and socially embedded strategies. Recent empirical studies underscore the potential of leveraging community networks and local social norms to foster a culture of energy efficiency. For example, visible retrofitting measures in a neighbourhood can create a "contagion effect," whereby the successful implementation by early adopters encourages

subsequent retrofits among neighbours (Dixon and Eames, 2013). Furthermore, the advent of advanced digital platforms that offer transparent, personalised guidance on retrofitting options holds promise in demystifying the retrofit process, thereby empowering homeowners with the information necessary to make informed decisions. Moreover, the growing recognition of the co-benefits associated with retrofitting, such as improved indoor air quality, enhanced thermal comfort, and reduced household energy bills, presents a compelling value proposition that can transcend purely environmental motivations (Wade and Visscher, 2021).

On the supply side, addressing market fragmentation is paramount. Small and medium-sized enterprises (SMEs), which represent a significant proportion of the retrofitting industry, often face challenges arising from disjointed supply chains, persistent skill shortages, and inconsistent regulatory frameworks (Killip, 2013). Such models, supported by robust training and certification programmes, would not only improve service quality but also bolster consumer confidence. One promising avenue for overcoming these issues is the development of integrated service models or "one-stop-shop" approaches, whereby a single provider manages the entire retrofit process, from initial assessment through to installation and ongoing maintenance (Mahapatra et al., 2013). Such models could streamline the retrofit journey and significantly enhance consumer confidence. In tandem, bolstering vocational training and certification programmes for retrofit professionals is essential to elevate service quality and address the skills gap that currently hampers sectoral growth (Ma et al., 2012).

Retrofitting existing buildings stands out as a highly effective strategy for improving energy performance, extending building lifespans, and ensuring occupant comfort, aligning with global sustainable development goals in the face of natural resource depletion and climate change (Khairi, Jaapar and Yahya, 2017). Retrofitting enhances space efficiency, lowers operational costs, and cuts down on energy use by redesigning building parts and assessing how occupants use the space (Kumar and Nayal, 2020). Building renovations have been difficult to initiate on a large scale, even with the potential for energy and emission savings because current standards primarily target new constructions and do not adequately address the numerous technical, functional, and economic limitations of existing ones (Ferreira and Almeida, 2015). The push for architectural and structural retrofitting, combined with meeting new community and market needs, is essential for maximising campaign benefits and adjusting to our rapidly evolving society (Scuderi, 2019). This transition necessitates the establishment of a quality mark to ensure adherence to appropriate standards in retrofit work (Rickaby, 2021). Moreover, by emphasizing the significance of stakeholder engagement, effective policy implementation, and the integration of sustainable practices, retrofitting endeavours can transcend mere structural upgrades and become catalysts for holistic community development (Nigam and Akhtar, 2021). Hence, to ensure successful outcomes and maximize the sustainability merits of retrofitting existing building stocks, it is important to embrace social, cultural, and material values and practices (Wade and Visscher, 2021).

While these challenges are substantial, a holistic, multi-faceted approach that combines innovative financial mechanisms, strategic communication, and community-based engagement presents a viable pathway towards mainstreaming retrofitting. By shifting retrofitting from a niche, technologically driven practice to one that is socially embedded and widely accepted, the built environment can play a pivotal role in helping the United Kingdom achieve its net-zero ambitions. The integration of historical insights with contemporary best practices is instrumental in realising this vision, ensuring that retrofit initiatives are not only technically feasible but also economically viable and socially sustainable in the long term.

3.1 Households' Motivations and Barriers

Household decision-making regarding retrofitting is determined by a complex, interdependent interplay of financial, social, and psychological factors. Financial considerations, such as the potential for reduced energy bills and increased property values, remain paramount. However, trust in service providers and the availability of clear, reliable information are equally critical. Many households are uncertain about the payback period associated with retrofit investments, and concerns over potential disruptions or the perceived hassle of installation further contribute to psychological barriers (Wilson, Pettifor and Chryssochoidis, 2018). These factors create a notable value-action gap wherein individuals may express pro-environmental intentions yet refrain from acting on them due to perceived risks and uncertainties.

Social norms also exert a profound influence on retrofitting adoption. Empirical evidence indicates that potential adopters are more likely to engage in retrofitting when they observe their peers or neighbours successfully implementing such measures, thereby generating a social contagion effect (Bernheim, 1994). Nonetheless, it is essential to recognise the diversity in household priorities. For some, sustainability narratives may appear overly didactic, leading them to prioritise more immediate, pragmatic benefits such as enhanced energy security or personal comfort. This heterogeneity in motivations necessitates the development of nuanced, segmentation-based communication strategies tailored to the distinct needs and preferences of different household groups.

3.2 Suppliers' Perspectives

From the perspective of suppliers, market dynamics and operational challenges significantly shape the adoption of retrofitting measures. SMEs, which form a substantial portion of the retrofitting sector, often grapple with fragmented supply chains, persistent skill shortages, and regulatory inconsistencies that impede their ability to deliver high-quality, consistent services (Killip, 2013). These constraints not only undermine consumer confidence but also limit the potential for market expansion. Addressing these supply-side inefficiencies is critical to establishing a seamless and effective retrofitting ecosystem.

Beyond these operational challenges, suppliers must also work to overcome entrenched consumer scepticism. Households frequently approach retrofitting with caution, deterred by concerns over hidden costs, substandard workmanship, or unfulfilled promises. Suppliers who adopt transparent pricing structures, provide detailed cost-benefit analyses, and implement customer-centric service models are more likely to build trust and foster long-term engagement. Moreover, integrating innovative financing mechanisms, such as performance-based contracts or shared savings models, can help to mitigate the impact of high upfront costs, thereby positioning retrofitting as a financially viable investment (Prabatha, Hewage and Sadiq, 2022).

By aligning their strategies with consumer expectations, suppliers have the potential to transform retrofitting from a perceived logistical and financial burden into a value-driven opportunity. This transformation requires not only improvements in operational efficiency but also proactive engagement strategies that emphasise reliability, affordability, and the long-term benefits of retrofit investments.

3.3 The Role of Theoretical Perspectives

The complex dynamics observed among households and suppliers in the context of retrofitting can be best understood through the application of three foundational theoretical perspectives: social embeddedness, behavioural nudges, and transitions theory. Granovetter, 1985) concept of social embeddedness posits that economic decisions are inextricably linked to social structures, networks, and relationships. Within the retrofit context, this perspective suggests that trust, interpersonal networks, and community influences play a decisive role in shaping household decision-making. When individuals observe successful retrofit projects within their social circles, the resulting community-driven adoption patterns can significantly accelerate the diffusion of energy-efficient practices. Behavioural nudges, as conceptualised by Thaler (2008), offer a complementary lens by highlighting the efficacy of subtle, strategically designed interventions aimed at overcoming cognitive biases and decision inertia. Interventions such as simplified information delivery, peer endorsements, and opt-out schemes can encourage households to adopt energy-efficient practices with minimal disruption to their existing routines. When these nudges are embedded within broader social frameworks, they have the potential to catalyse substantial shifts in retrofitting uptake.

Finally, transitions theory, as articulated by Geels (2002), situates retrofitting within a broader socio-technical landscape. This theory elucidates how niche innovations, when aligned across micro (individual decisions), meso (market structures and supply chains), and macro (policy and regulatory frameworks) levels, can disrupt established regimes and facilitate systemic transformation. This multi-layered perspective underscores the necessity of coordinated, multi-stakeholder efforts to create an enabling environment for large-scale, long-term retrofitting adoption.

Collectively, these theoretical insights reveal that financial and technical factors, while undeniably important, do not solely dictate the adoption of retrofitting measures. Instead, the intricate interplay of social influences, market dynamics, and policy interventions forms the cornerstone of any effective strategy aimed at driving widespread and sustainable retrofitting adoption.

Addressing the current barriers and harnessing emerging opportunities requires a holistic strategy that incorporates both demand- and supply-side perspectives. This approach will not only enhance our understanding of retrofitting adoption but also inform practical interventions that can lead to a more sustainable, energy-efficient future.

4. The Future: Towards a Socially Embedded Retrofitting Ecosystem

The future of retrofitting hinges on much more than the mere advancement of technology or the provision of financial incentives. It necessitates the development of an integrated, socially embedded ecosystem that skilfully synchronises policy initiatives, market dynamics, and community-driven engagement. As the United Kingdom steadily progresses towards its Net Zero 2050 target, it is imperative that retrofitting becomes a central pillar of sustainable living, not only as an isolated technical fix but as a transformative socio-technical endeavour.

A key pillar of this vision is the establishment of stable, long-term policy frameworks that provide continuity and certainty for both households and industry stakeholders. Historical initiatives, such as the Green Deal, have illustrated the pitfalls of short-term schemes burdened by excessive administrative complexity and inconsistent funding (Rosenow and Eyre, 2016). Future policies must overcome these challenges by ensuring the provision of consistent subsidies, performance-based incentives, and well-integrated regulatory measures that effectively lower financial barriers and foster enduring consumer confidence. This calls for a paradigm shift wherein policies are designed with a long-term perspective, embracing both quantitative targets and qualitative community benefits.

Equally critical is the implementation of innovative financing models that reframe retrofitting from a costly, upfront expenditure into a sustainable investment. Mechanisms such as Pay-As-You-Save (PAYS) schemes and green mortgages have already demonstrated significant potential in this regard (Fawcett and Topouzi, 2020). By aligning repayment schedules with actual energy savings, these financial instruments not only improve affordability but also incentivise continuous investment in energy efficiency. Furthermore, emerging financing approaches such as shared savings models and performance contracts could further enhance accessibility, enabling a broader spectrum of homeowners to participate in retrofitting programmes. Additionally, efforts to promote retrofitting should also be framed within the broader context of social justice, addressing the issue of "retrofit poverty," which refers to the inequitable distribution of opportunities to improve home energy performance (Willand et al., 2020).

Technological advancements will also play a central role in shaping the future retrofitting landscape. Digital platforms that offer personalised energy assessments, streamlined supplier comparisons, and blockchain-based transparency for certification and energy savings verification stand to revolutionise the market. When these technological innovations are coupled with targeted social marketing campaigns and robust community-led initiatives, they have the potential to transform retrofitting from a marginal, niche activity into a widely accepted social norm. This is exemplified by the Energiesprong model in the Netherlands, where prefabricated retrofit solutions are combined with service guarantees and local job creation to deliver holistic, community-based energy improvements (Energiesprong, 2024).

The vision of a socially embedded retrofitting ecosystem requires an integrated approach that bridges policy, finance, digital innovation, and community engagement. Addressing both demand- and supply-side challenges, this comprehensive strategy has the potential to mainstream retrofitting as a normative and desirable practice. Such a shift is not only critical for achieving the UK's broader energy efficiency and climate resilience objectives but also for fostering economic growth and social cohesion. As future research continues to evaluate the efficacy of these integrated models, it is essential to pursue empirical evaluations across diverse socio-economic contexts, ensuring that proposed solutions are both scalable and equitable.

4.1 Speculative Analysis: Envisioning a Future with High Retrofitting Adoption

Imagine a future in which retrofitting is not an exception but the norm, deeply embedded within societal values and supported by a comprehensive network of policies, technological innovations, and community initiatives. In such a scenario, the built environment undergoes a transformative shift; individual homes and commercial properties become integral components of a highly interconnected, energy-efficient network. Technological advancements such as smart grids, district heating systems, and AI-driven energy optimisation not only improve individual building performance but also contribute collectively to national climate targets (Al-Saadi, Al-Greer and Short, 2021).

In this future landscape, innovative financial mechanisms ensure that retrofitting is accessible to all socio-economic groups. Dynamic Pay-As-You-Save (PAYS) schemes, green mortgages, and government-backed incentives work in tandem to alleviate high upfront costs, while an agile and continuously upskilled workforce ensures that industry capacity evolves in lockstep with demand. Consequently, households experience enhanced thermal comfort, reduced energy expenditures, and increased property values, while suppliers benefit from a matured, optimised market characterised by operational efficiencies and trust-based consumer relationships.

Moreover, retrofitting is reconceptualised as a critical component of broader urban sustainability transitions (Foggia, 2018). It becomes an integral part of urban planning, where policy, technology, and community action converge to create resilient, low-carbon

neighbourhoods. Global exemplars such as Bahnstadt in Heidelberg illustrate how large-scale, net-zero retrofitting initiatives can transform entire communities, enhancing both energy efficiency and liveability (TIME, 2024). By embedding retrofitting within a systemic sustainability agenda, the built environment is reimagined as a dynamic, responsive asset in the fight against climate change.

4.2 Policy Innovations, Industry Shifts, and Future Research Directions

Achieving this ambitious vision necessitates substantial policy innovations that extend well beyond short-term, reactive measures. Policymakers must adopt long-term, holistic strategies that not only provide stability and certainty but also integrate retrofitting within broader urban development and climate resilience frameworks. The successful implementation of performance-based incentives and comprehensive regulatory measures will lower financial barriers and cultivate a culture of continuous improvement in energy efficiency (Rosenow and Eyre, 2016). Moreover, aligning retrofitting policies with national and local planning initiatives can generate synergistic benefits that enhance both economic and environmental resilience.

Equally pivotal are the industry shifts required to support large-scale retrofitting efforts. The retrofitting sector must transition towards integrated service models that streamline the entire customer journey, from initial energy assessments through to installation and long-term maintenance. Such "one-stop-shop" approaches, combined with initiatives to bolster vocational training and standardised certification programmes, can address prevalent skill shortages, and improve overall service quality (Killip, 2013). Investment in workforce training and certification will be crucial in addressing current skill shortages and ensuring that service quality is maintained as demand increases. Future research should prioritise rigorous empirical evaluations of emerging retrofitting models, including digital innovations like AI-driven energy management systems, blockchain-enabled certification schemes, and data-driven behavioural nudges, to ensure these technologies can be effectively integrated within existing policy frameworks.

4.3 The Importance of Public Engagement, Participatory Governance, and Long-Term Financial Planning

A truly sustainable retrofitting ecosystem hinges on active and inclusive public engagement. Retrofitting should be framed not merely as an economic transaction but as a societal endeavour that strengthens community resilience and environmental responsibility. Public engagement strategies must prioritise transparency, accessibility, and education, ensuring that households understand the long-term benefits and cost savings of retrofitting. Community-led initiatives, such as neighbourhood champions, cooperative retrofit projects, and peer-to-peer advisory networks, are essential for fostering trust and normalising energy efficiency practices (Stieß and Dunkelberg, 2012).

Participatory governance models that actively involve citizens in local decision-making processes are also critical for enhancing policy responsiveness and efficacy. By integrating the insights of households, industry stakeholders, and community leaders, governments can craft policies that are both well-informed and widely accepted. Simultaneously, long-term financial planning must secure sustained investment in retrofitting infrastructure (Zhang, 2023). This requires not only direct subsidies and low-interest financing options but also the development of innovative financial instruments that align repayments with actual energy savings, thereby reducing the financial burden on homeowners (Thaler, 2008).

In conclusion, a future in which retrofitting is economically viable, socially embedded, and technologically advanced demands a coordinated, multi-stakeholder approach. By cultivating a policy landscape that is both ambitious and pragmatic, the UK can lead the global transition towards a resilient, energy-efficient built environment capable of meeting the sustainability challenges of the coming decades.

5. Conclusion: A Call for Action

The transformation of the built environment through retrofitting is far more than a technical or economic adjustment, it represents a fundamental socio-technical revolution. The findings of this study demonstrate that retrofitting is shaped not only by financial considerations and regulatory mandates but also by deeply entrenched social relationships, behavioural tendencies, and systemic infrastructural dynamics. Achieving widespread adoption requires that retrofitting be firmly integrated within national sustainability strategies, urban development policies, and community engagement frameworks. To this end, policymakers must establish stable, long-term regulatory environments that empower both homeowners and industry stakeholders to invest in retrofitting with confidence.

The expansion and further development of innovative financing schemes, such as dynamic Pay-As-You-Save models and green mortgages, are essential for mitigating high upfront costs and ensuring equitable access to retrofitting opportunities (Fawcett and Topouzi, 2020). Concurrently, industry actors need structured support to scale capacity-building efforts, ensuring that supply chain efficiency and workforce competency evolve in tandem with increasing demand (Killip, 2013). Such measures, when combined with comprehensive policy reforms, can help transform retrofitting from a sporadic, marginal activity into a mainstream, normatively embedded practice.

Equally crucial is the cultivation of a robust sustainability culture. Granovetter (1985) reminds us that economic decisions are inextricably linked to social networks, underscoring the importance of visible, community-led initiatives in driving behavioural change. Likewise, behavioural insights by Thaler (2008) illustrate how well-crafted nudges can overcome cognitive inertia, thereby promoting energy-efficient choices at the household level. In parallel, transitions theory (Geels, 2002) emphasises the necessity of aligning interventions across micro, meso, and macro levels to achieve systemic transformation.

Taken together, these interdisciplinary perspectives form the cornerstone of a coordinated, multi-stakeholder approach that bridges policy imperatives, market dynamics, and community engagement strategies. In short, retrofitting must be framed as a collective endeavour, fostering a sense of shared responsibility and mutual benefit (Bolton et al., 2022).

As the urgency of climate action intensifies, the need for innovative and scalable retrofitting solutions becomes ever more paramount. By embedding retrofitting within the social and economic fabric of communities, the United Kingdom can shift from incremental improvements to a large-scale, transformative retrofitting revolution. In doing so, every retrofitted home contributes to a greener, more resilient future, aligned with both national and global sustainability ambitions. This study calls for sustained commitment, cross-sector collaboration, and an unwavering focus on sustainability to reimagine retrofitting as an indispensable pillar of the low-carbon transition.

6. Personal Reflection and Visionary Closing Statement

Reflecting on my journey as a researcher, I am continually struck by the profound responsibility and privilege inherent in examining retrofitting at such a critical juncture in history. The unprecedented urgency of the climate crisis, coupled with the enduring legacy of energy-inefficient housing, compels me to explore the intricate socio-behavioural dimensions that underpin retrofitting adoption. My research transcends the boundaries of a mere academic exercise; it has evolved into a sincere quest to understand, influence, and ultimately transform how everyday decisions within the built environment can pave the way for a more sustainable and equitable future.

In delving into the complex dynamics of trust, social embeddedness, and systemic challenges, I have come to appreciate that retrofitting is not solely a technical endeavour, it is also a profoundly human and culturally embedded pursuit. This realisation is reinforced by concrete examples drawn from community-led projects and collaborative initiatives in urban areas, where the collective actions of households, local authorities, and industry stakeholders have yielded measurable environmental benefits. The resilience of communities, the adaptive strategies of suppliers, and the interplay of financial and social factors collectively shape a landscape where every retrofit decision can produce tangible, lasting environmental impact.

Looking forward, I ardently advocate for a visionary and integrated approach to sustainability transitions, one that is both socially driven and resiliently future-proofed. This vision calls for the development of policies and market practices that not only address immediate financial and technical barriers but also nurture a pervasive culture of collective action and shared responsibility. A comprehensive strategy is required, one that converges stable, long-term policy frameworks, innovative financing mechanisms, and robust community-led initiatives to create an inclusive and effective retrofitting ecosystem.

Such an ecosystem would empower households by equipping them with the necessary tools and knowledge, enhance supplier engagement through standardised and transparent service models, and ultimately reframe retrofitting from a marginal, niche intervention into a widely accepted, socially embedded norm. By drawing upon interdisciplinary insights from behavioural economics, social network theory, and advanced technological innovations, we gain a more holistic understanding of retrofitting as both an engineering challenge and a socio-cultural phenomenon. Only through coordinated, sustained interdisciplinary efforts can we realise a truly sustainable future, one in which every home plays a meaningful role in advancing the broader national and global goals of decarbonisation and energy resilience. In conclusion, my reflections reaffirm that retrofitting is not merely about upgrading buildings technically, but about forging a collective, transformative pathway towards sustainability. I hope that this research not only illuminates the inherent challenges but also inspires innovative solutions that catalyse a sustainable transition for future generations. It is my sincere conviction that by harnessing the power of interdisciplinary collaboration and embracing a holistic approach, we can effectuate a retrofitting revolution that leaves an indelible mark on our built environment and contributes decisively to the fight against climate change.

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ON THE BRINK: ACADEMIC PROBATION AND THE RISK OF DROPOUT IN AN OMANI HIGHER EDUCATION CONTEXT

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Abstract

This study presents findings from a mixed-methods investigation conducted at a college in Oman, which examined the challenges faced by students at risk of dropping out, with a particular focus on those placed on academic probation. Drawing on the conceptual framework developed by Brown et al. (2022), which conceptualises higher education dropout as a process through which social inequalities are expressed and reproduced, the study contributes to the limited body of research on student dropout within the Omani higher education context. It offers a distinctive perspective by highlighting the structural, institutional, social, familial, and personal dimensions that influence dropout risk.

By incorporating student perspectives, the research reveals how these interrelated challenges shape academic trajectories and points to the need for more inclusive policy responses. The analysis underscores the complex interplay between structural and institutional constraints and their psychological effects on students. Although access to university in Oman is relatively open due to the availability of state-funded scholarships for high-achieving secondary school graduates, numerous barriers to persistence remain concealed and inadequately addressed. Students' accounts illustrate how institutional culture, academic support structures, and socio-emotional pressures contribute significantly to academic disengagement and eventual withdrawal.

The study concludes by calling for a systemic and institution-wide commitment to student support, particularly for those from disadvantaged backgrounds. This includes the promotion of cognitive, social, emotional, and mental well-being through targeted academic interventions, mentorship schemes, and culturally responsive pedagogies. The findings highlight the urgent need for higher education institutions to reframe student retention as a holistic and inclusive process. Future research is encouraged to undertake longitudinal analyses of dropout patterns to evaluate the long-term impact of institutional reforms and identify further strategies for supporting at-risk students.

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Keywords: Dropout, Higher Education, Academic Probation, At-Risk Students, Early School Leavers.

1. Introduction

1.1 Rationale and Significance of the Research

Higher education enrolment has expanded rapidly across industrialised nations, driven by the belief that a university degree is significant for career success and social mobility (OECD, 2000; Lehmann, 2007). This reflects Becker's (1994) human capital theory, which highlights the economic benefits of education for individuals and society. Recent evidence confirms that higher education enhances employability and productivity (Marginson, 2019; Hanushek & Woessmann, 2020).

Despite these advantages, student dropout remains a global challenge. Tinto's (1987) model, which links student integration with retention, continues to guide research in this field. Scholars such as Kahu and Nelson (2018) and Thomas (2012) highlight the importance of belonging, engagement, and institutional support in preventing attrition. These challenges are intensified by rising financial pressures and mental health issues (Grawe, 2018; Baum & Steele, 2018).

While dropout is a widely studied issue globally, it remains underexplored in Oman despite an estimated 7,000 students exiting higher education annually (Oman Observer, 2019). Contributing factors include academic disinterest, socio-economic pressures, poor institutional support, and cultural adjustment difficulties (Zawya, 2017; Al-Issa & Al-Najjar, 2021). This study uses Brown et al.'s (2022) five-tier risk framework to explore these factors in depth and generate insights for evidence-based policy responses.

In Oman, public higher education is tuition-free and state-funded, primarily through oil revenues. Oman's Vision 2040 places human capital development at the centre of national progress. Yet, persistently high dropout rates threaten these goals and undermine the justification for continued public investment in higher education (Al-Alawi et al., 2023). Al-Hajry (2002) warned of the long-term sustainability risks of such financing, and recent studies reinforce the urgency of diversifying revenue sources (Alshukaili & Aboud, 2021; World Bank, 2012). Tuition-free education may inadvertently affect student motivation and staff assumptions about financial security, possibly leading to limited engagement and weakened accountability.

Importantly, not all dropouts are due to academic failure. In Oman, alternative career pathways such as entrepreneurship are increasingly seen as viable, particularly given concerns over graduate unemployment and limited job market alignment with qualifications (Al-Harthi, 2011; Bineid, 2023). This aligns with global trends where students question the return on investment of higher education and may opt out voluntarily in favour of more immediate or practical opportunities.

Mental health challenges, including depression and anxiety, also significantly affect student performance and retention, especially when combined with social and financial stressors

(Al-Busaidi et al., 2011). Yet students are often framed as deficient in motivation or ability (Ross & Leathwood, 2013), while institutional factors, such as curriculum design and inadequate support, are overlooked.

Higher Education Institutions (HEIs) are increasingly expected to prepare students for academic success and emotional resilience (Chemi & Krogh, 2017). However, rising probation and dropout rates reflect the failure of many institutions to meet these expectations (Christie et al., 2008). Academic probation is typically defined as a GPA below 2.0 (SQU Academic Procedure, 2020), which often precedes withdrawal and signals a more profound need for intervention.

There is a notable gap in including student perspectives in research on dropout. This study addresses this by comparing the views of Omani students on academic probation with those of university counselling staff, highlighting areas of alignment and divergence (Downes, 2013; Holte, 2017; Brown et al., 2022).

Research Questions

- 1. What challenges do Omani students on academic probation perceive as hindering their transition, progress, and retention in higher education?*
- 2. How do the risks identified by students and those articulated by counselling staff reflect interconnected patterns or differing perspectives?*

1.2 Study Context and Background

This study was conducted at one of Oman's most prominent public universities, which offers tuition-free undergraduate education. Primary data were collected from a selected college, with institutional anonymity preserved. The participants were Omani nationals aged 18–23 and had completed secondary education and pursued various specialisations. The study focused on students on the third and fourth levels of academic probation, deemed most at risk of dropout. Those on first-level probation were excluded due to their higher likelihood of academic recovery.

Though from the same college, participants reflected diverse regional, social, and economic backgrounds. Eight students (four male, four female) were interviewed in Arabic, alongside three university counselling staff. Oman's conservative Islamic and tribal culture strongly shapes educational and social expectations (Al-Azri, 2013), influencing how students navigate family obligations, institutional life, and personal aspirations, factors that underpin their educational trajectories and responses.

2. Literature Review

2.1 Terminology Associated with Student Dropout

Student withdrawal from higher education is a complex phenomenon, often referred to by various terms such as attrition, disengagement, early leaving, or dropout (Egermeier, 1963; Kim, 2022). While these terms are sometimes used interchangeably, they reflect distinct disciplinary and contextual understandings. Tinto (1987c) argues that all forms of early departure represent the loss of a potential graduate and a reduction in institutional revenue, highlighting the financial and reputational consequences of dropout for universities (Bowen, Chingos, & McPherson, 2011).

However, scholars caution against conflating all instances of student departure under a single umbrella term. Factors such as financial hardship, inadequate academic preparation, or mental health issues require different institutional responses (Braxton et al., 2014; Kahu & Nelson, 2018). Overgeneralisation can lead to misplaced policies that assume institutions alone can resolve all forms of attrition, even when some causes lie beyond their influence (O’Keeffe, 2013; Deming & Walters, 2018).

Recent literature, particularly from Europe, has expanded the vocabulary further with terms such as Early School Leaving (ESL), Early Leaving from Education and Training (ELET), and Not in Education, Employment or Training (NEET), reflecting more nuanced efforts to understand disengagement across educational levels (Brown et al., 2021). To ensure conceptual clarity, this study adopts the term college student dropout to refer specifically to individuals aged 18-25 who leave undergraduate study prematurely. This aligns with Brown et al.’s (2022) multidimensional risk framework and situates dropout within the developmental stage of emerging adulthood (Georgeta, 2023).

Emerging adulthood is a critical period marked by identity exploration, academic transitions, and personal growth. Young adults often encounter emotional, psychological, and socio-economic pressures that may profoundly shape their educational experiences and contribute to withdrawal.

2.2 Why Focus on Emerging Adulthood?

With over 44% of Oman’s population aged between 15 and 24 (World Bank, 2022), there is a pressing need to understand how higher education systems engage with this demographic. Emerging adulthood, typically spanning the late teens to mid-twenties, is characterised by increased independence, delayed family formation, and redefined career expectations (Georgeta, 2023). It is also a period of heightened vulnerability, during which students may reevaluate traditional pathways and consider alternative life trajectories.

Research highlights that premature withdrawal from higher education can have lasting negative consequences. Early leavers may face stigma, limited employability, and challenges integrating into professional or social domains (De Witte et al., 2013). In Oman, where limited local research examines the relationship between developmental stage and educational persistence, it is crucial to recognise how emerging adulthood intersects with student vulnerability.

Tinto's Student Integration Model (1993) and Bourdieu's Theory of Cultural Capital (1977) have influenced the understanding of student retention. Tinto emphasises the importance of academic and social integration, students must align with institutional expectations and feel a sense of belonging. However, in the Omani context, students from disadvantaged or rural backgrounds often struggle with both, lacking prior exposure to higher education systems (Al-Issa & Al-Najjar, 2021). Inadequate academic support and mentoring may compound their challenges, increasing the risk of disengagement.

Bourdieu's concept of cultural capital explains disparities in academic success. Students from privileged families often possess linguistic, behavioural, and cultural competencies that match institutional norms. In contrast, first-generation or low-income students may find university environments alienating. While scholarships increase access, they do not bridge this cultural gap. Without tailored institutional strategies, such students remain at a higher risk of failure and dropout.

Thus, a combined application of Tinto's and Bourdieu's frameworks reveals the importance of fostering academic engagement and creating inclusive environments that mitigate systemic inequalities. Institutional reforms must move beyond technical provision to address the socio-cultural dynamics influencing retention.

2.3 Bronfenbrenner's Ecological Systems Theory and Brown's Framework

To better understand dropout in the Omani context, this study draws on Bronfenbrenner's Ecological Systems Theory and Brown et al.'s framework on the educational binds of poverty. Bronfenbrenner's model situates learners within a series of interrelated systems, from family and peers to school policies and socio-economic structures, that collectively shape educational outcomes (Bronfenbrenner & Morris, 2006).

Brown et al. (2021; 2022) complement this perspective by examining how material hardship, institutional barriers, and social inequalities intersect with student experiences. Their longitudinal research tracks educational pathways over five years, highlighting how transitions between levels of education are particularly fraught for disadvantaged learners. These students are more likely to be labelled as failures, experience social exclusion, and suffer long-term emotional and financial consequences (Joseph et al., 2021).

While Bronfenbrenner's theory is widely applied, it has been critiqued for insufficiently accounting for students' unique challenges in poverty (Gairín & Suárez, 2012). Brown's framework addresses this gap, stressing the importance of student agency and narrative within constraint systems. The concept of "educational binds of poverty" captures how individuals make sense of their academic journeys amid structural disadvantage (Brown, 2014).

This study adopts Brown et al.'s five-tier risk model: personal, social, institutional, familial, and structural, as an analytical tool to assess student dropout in Oman. By integrating ecological and longitudinal insights, the research provides a more holistic and context-sensitive understanding of student disengagement in a conservative, state-funded higher education system.

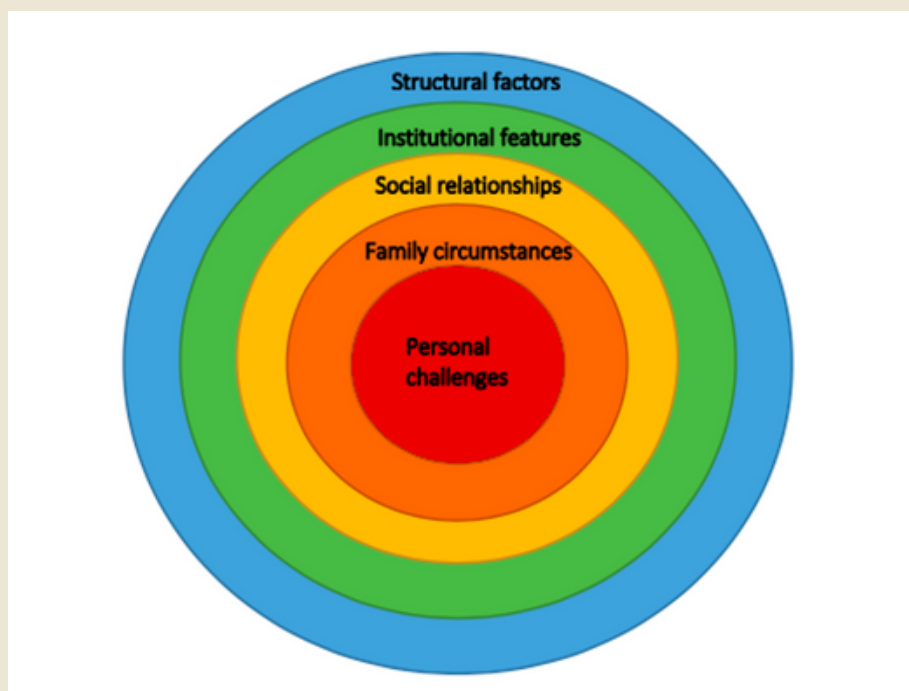


Figure 1. A model for conceptualising the categories of risk factors to ESL

2.4 Brown's Five-Tier Framework and Bronfenbrenner's Ecological Systems Theory

Brown et al. (2021) integrate Bronfenbrenner's Ecological Systems Theory (1979) with the concept of 'educational binds of poverty' (Brown, 2014), to identify five domains of dropout risk: structural, institutional, social, familial, and personal. Structural risks include macro-level constraints such as economic instability and policy gaps, where increased access without adequate support fails to ensure meaningful inclusion (Engstrom & Tinto, 2008). Institutional factors encompass teaching quality, infrastructure, policy design, and language barriers, issues notably present in Omani universities (Al Mahrooqi & Al-Maamari, 2018).

Social risks stem from peer relationships and isolation, while familial challenges relate to financial hardship, educational background, and cultural expectations (Al Azri, 2012). Personal risks include mental health, trauma, and behavioural issues, exacerbated in Oman by post-COVID stress (Malik & Javed, 2021).

2.5 Contrasting Student and Adult Perspectives

Brown et al. (2022) observe that students and educators often diverge in their interpretations of dropout causes. While adults emphasise structural and personal challenges, students frequently cite institutional and social concerns. This highlights the need to foreground students' voices in dropout research and to recognise the influence of both micro-level experiences and macro-level contexts (Grace, Hodge, & McMahon, 2017). Students on academic probation, typically those with a GPA below 2.0, often face poor study skills, low motivation, and unclear goals (Cuseo, 2003). Without timely intervention, probation may lead to dismissal. However, it can also be transformative when accompanied by personalised academic and emotional support (Stevens & Ellerbrock, 1995).

While this study is grounded in Bourdieu's (1977) theory of cultural capital, it also considers Human Capital Theory and Student Engagement Theory. The former frames dropout as a rational response to perceived low returns on education (Becker, 1964), while the latter emphasises academic and social integration as key to retention (Kuh, 2007; Trowler, 2010).

3. Methodology

3.1 Epistemological and Philosophical Perspectives

This study adopts an integrated framework combining Critical Realism (CR) with a constructivist phenomenological case study to investigate the multi-dimensional experiences of college students at risk of dropout. While CR posits that an objective reality exists independently of human perception, it acknowledges that it can only be accessed through subjective interpretation. It seeks to uncover underlying, often unobservable, mechanisms that shape social phenomena (Kozhevnikov & Vincent, 2019). This makes CR particularly well-suited for exploring the systemic structures affecting student outcomes.

Phenomenology complements this by focusing on individuals' lived experiences, aiming to understand how they perceive and make sense of their educational journeys (Cohen et al., 2017). A case study design enables an in-depth exploration of these experiences within a bounded institutional context (Merriam et al., 2016), thereby enriching the analysis of both structural influences and personal meaning-making.

3.2 Research Methods and Setting

Consistent with CR's methodological openness, this study employs a mixed-methods approach. Primary data were collected through semi-structured interviews with eight students on third or fourth level academic probation and four university counselling staff. These interviews were conducted virtually to accommodate participants studying abroad and were audio-recorded (with consent), following ethical standards (Sargeant, 2012).

The college and university involved are anonymised to protect participant confidentiality. Students on the first and second levels of probation were excluded, as institutional policy considers them less vulnerable to dropout. The final sample included equal numbers of male and female students, selected through purposive sampling to ensure variation in gender, academic level, and probation experience (Patton, 2015).

3.3 Mixed-Methods Design

The study used qualitative and quantitative components. Institutional dropout data provided the initial quantitative context, while interviews offered deeper qualitative insights into students' academic difficulties, emotional states, and support experiences (Long & Noor, 2023). This triangulation enhanced the robustness of findings and allowed the integration of broader patterns with individual narratives (Malina et al., 2011). Despite attending the same college, participants were diverse in terms of region, socio-economic background, and personal aspirations. This diversity ensured that a range of experiences could be captured.

3.4 Data Analysis

Interview data were analysed using thematic inductive analysis (Braun & Clarke, 2006), guided by principles from grounded theory (Corbin & Strauss, 1994). Open and axial coding techniques were used to generate initial codes and group them into broader thematic categories. A literature-informed framework supported the initial coding process, while remaining open to emergent themes.

Member checking was conducted with student participants to enhance credibility to validate the researcher's interpretations (Curtis et al., 2014). The research process also prioritised reflexivity, ensuring that the researcher's positionality, assumptions, and biases were acknowledged and critically examined (McGarry, 2016).

3.5 Ethical Considerations

Ethical approval was granted by the University of Bath's School of Education Ethics Committee, under SSREC guidelines. Participants were fully informed about the study's purpose, procedures, and data usage. Written consent was obtained following a period of

review, and participants were reminded of their right to withdraw at any stage before data analysis (Cohen, 2017). To protect anonymity, pseudonyms were used, and interviews were conducted in private, secure virtual environments. Special care was taken to minimise power imbalances, particularly given the vulnerability of the student participants (BERA, 2018; Hyder & Wali, 2006).

3.6 Limitations of the Study

As a qualitative case study, the research prioritises depth over breadth and does not aim for statistical generalisability (Flyvbjerg, 2006). The small sample size limits external applicability, but offers rich, context-specific insights with potential relevance for similar institutional settings (Denscombe, 2003). The exclusion of 1st and 2nd-level probation students, due to time constraints, represents a limitation, as does the absence of lecturers' perspectives. These omissions may restrict the understanding of institutional analysis, but do not detract from the study's objective of exploring the lived experiences of high-risk students.

4. Findings

This section presents key findings from individual interviews with eight Omani students, supported by institutional data from the target university. As detailed in the methodology, the interviews were analysed using Braun and Clarke's (2006) thematic approach. Prior to the qualitative findings, relevant statistical data are provided to contextualise the scope of academic probation at the institution.

4.1 Academic Probation at the Target University

In the 2022–2023 academic year, the university reported a total enrolment of approximately 12,000 students. Of these, 2,373 (over 20%) were placed on academic probation, a substantial proportion that signals systemic academic challenges (refer to Table 1). According to the university's academic progression policy, probationary students are categorised into three main levels. A fourth probation level may be permitted under exceptional circumstances, but reaching the third level typically signals imminent risk of permanent withdrawal (Bowman & Jang, 2022).

Probation Level	Frequency	%	Valid %	Cumulative %
First Probation	1402	59.1	59.1	59.1
Fourth Probation	70	2.9	2.9	62
Probation Level More 4	1	0	0	62.1
Second Probation	284	12	12	74
Third Probation	616	26	26	100
Total	2373	100	100	100

Table 1: Probation Percentage Levels

Level of Probation	Frequency	Percentage
First Probation	1402	59.1.4
Second Probation	284	12
Third Probation	616	26
Total	2373	100

Table 2: Showing the Probation Levels

Table 2 shows that 1,402 students (59.1%) were on their first probation. Concerningly, 26% had already reached the third level, placing them at high risk of exclusion. These statistics underscore the urgent need for tailored support mechanisms to improve retention.

Course of study	Frequency	Percentage
Advance Diploma	294	12.4
Bachelor	39	1.6
Diploma First Year	1130	47.6
Diploma Second Year	910	38.3
Total	2373	100

Table 3: Showing Varying Course of Studies

As shown in Table 3, which illustrates the varying course of studies according to students' classification as 'at-risk' of dropout. Most interviewees were enrolled in diploma programmes. Bachelor's students represented only a small portion of the cohort, likely due to the more stringent English proficiency requirements for admission into degree-level programmes.

The concentration of probationary students in the early stages of their studies (Diploma First Year and Diploma Second Year) highlights the critical nature of academic transition support. This aligns with Tinto's (1993) findings on the importance of early academic integration for student success.

Department Name	Frequency	Percent	Valid Percent	Cumulative Percent
Applied Science	294	12.4	12.4	12.4
Business Studies	619	26.1	26.1	38.5
Engineering	906	38.2	38.2	76.7
Fashion Design	7	0.3	0.3	76.9
Information Technology	517	21.8	21.8	98.7
Pharmacy	12	0.5	0.5	99.2
Photography	18	0.8	0.8	100
Total	2373	100	100	100

Table 4: Probation levels against departments

Table 4 illustrates departmental patterns, with Engineering students accounting for the largest share of those on probation (38.2%), followed by Business Studies (26.1%), Information Technology (21.8%), and Applied Sciences (12.4%). Most interview participants were enrolled in Engineering and Applied Sciences, suggesting these disciplines may face unique academic or structural challenges, such as curriculum difficulty, language barriers, or limited academic support.

This study's findings ensured a diverse and representative sample by selecting participants based on probation level rather than academic year or field. This diversity enriches the thematic analysis and strengthens the basis for institution-wide policy interventions to improve student retention.

4.2 Answer to RQ1: *What Challenges Do Omani Students on Probation Perceive as Hindering Their Transition, Progress, and Retention in Higher Education?*

This section responds to the first research question by presenting thematic findings from student interviews. The challenges reported were not solely academic but reflected a complex interaction of educational, social, psychological, and personal factors.

4.2.1 Educational Challenges

Educational challenges were most frequently cited as contributing to students' probationary status. These included strained relationships with instructors, lingering impacts of COVID-19, language barriers, inflexible policies, limited academic support, and institutional grading systems.

A. Student-Instructor Relationships

Every participant identified difficulties with instructors as a major barrier to academic success. Several students described lecturers as unwilling to accommodate extenuating circumstances. One student recounted being denied a rescheduled quiz following the death of a sibling, leading to eventual expulsion. Another described a lecturer who dismissed a medical reason for missing an assessment, stating their only duty was to "deliver content" (Anonymous 1, 2023).

Others spoke of biased behaviour. One account described a gender-based discrepancy in disciplinary action, with a male student's phone being thrown away and a female student's handled respectfully in a similar incident (Anonymous 6, 2023). Several students expressed frustration with a lack of support during office hours and perceived mistreatment, noting that such experiences demotivated them and, in some cases, led to course withdrawal.

Conversely, participants highlighted how positive reinforcement and motivational feedback from lecturers significantly improved their morale and determination to persist (Anonymous 1, 6, and 8, 2023).

B. Exam Policies and Structural Inflexibility

Students expressed concern that re-take exams were more difficult than initial assessments and noted the rigidity in scheduling, even when exams clashed. One student received no help from their advisor, resulting in course failure and a decline in GPA (Anonymous 6, 2023).

C. Teaching Methods and Language Barriers

Lecturers reading directly from slides and offering minimal explanation left students struggling, particularly those with limited English proficiency. Participants emphasised the need for clearer instructions and more interactive teaching methods (Anonymous 5, 2023).

D. COVID-19 and the Legacy of Online Learning

The shift to online education during the pandemic disrupted learning continuity. The emphasis on mid-terms, final exams, and reduced formative assessment left little room for gradual academic recovery. Participants reported ongoing struggles with this structure, linked to their probation status.

E. English as a Medium of Instruction

Participants expressed mixed views regarding English as the language of instruction. As summarised in Table 5, some found it difficult but manageable, while others described it as a major barrier. Students attributed these struggles to their prior education, which predominantly used Arabic. The sudden transition to English-heavy curricula left many feeling linguistically underprepared.

	Manageable	Demanding	A challenge	Feasible
Anonymous 6		<i>English for Omanis is not that easy</i>		<i>It is not a hurdle on the way of passing our units of study</i>
Anonymous 7			<i>English affects the academic performance. When students transition to university level they are shocked by the content; all in English and they struggle with understanding the context. Since I started learning here in English, I started to hate FE.</i>	
Anonymous 8				<i>I don't see English as a problem to learning</i>
Anonymous 5		<i>Some teachers have different nationalities, and they don't speak proper English, so we struggle to understand them</i>	<i>In exams we find it really hard to understand the questions and the vocabulary used, beside the diagram that we need to memorise</i>	<i>It is not a problem as a language</i>
Anonymous 3			<i>Its the use of synonyms or the style of phrasing questions is not the way we're used to perceive it</i>	<i>I don't think English is an issue in students' way to progress academically</i>

Table 5: Students' Opinion on the English Learning (continued on next page)

	Manageable	Demanding	A challenge	Feasible
Anonymous 2		<i>Hard</i>	<i>English is an issue!</i>	
Anonymous 1		<i>My issue is understanding the question. I fail because I don't understand the question!</i>	<i>It is a big hurdle on the way!</i>	

Table 5: Students' Opinion on the English Learning

F. IELTS Band Score Requirements

IELTS testing emerged as a significant obstacle. To progress to higher academic levels, students must attain an overall score of 5.0, with no sub-score below 4.5. The financial burden of repeated IELTS attempts, now no longer subsidised by the university, was widely criticised. One student highlighted the unsustainable cost, noting that each test costs nearly OMR 90.

G. Academic Advising

Students also reported concerns about academic advising. Advisors were often perceived as unapproachable and unresponsive. Some students were enrolled in units without consultation, resulting in an overwhelming workload or unsuitable course selection. Others lacked clarity on how to recover from probation due to insufficient guidance.

H. GPA Thresholds and Curve-Based Grading

Several participants felt demoralised by rigid GPA requirements and curve-based grading systems, particularly within scientific departments. Even when well-prepared, students reported receiving low marks due to statistical adjustments that made academic success appear unattainable.

I. Changing Academic Specialisations

The absence of structured career counselling meant students often selected or changed majors without adequate information. One participant shifted from Engineering to Applied Sciences for job security but quickly lost interest, resulting in disengagement and probation.

J. Financial Strain

Many students faced severe financial difficulties. University allowances were insufficient, forcing students to work part-time to cover essential costs. Balancing employment with study demands led to exhaustion and poor academic performance. In some cases, students supported entire households, adding further stress.

4.2.2 Social Challenges

Students identified both supportive and disruptive social influences. Peer and family interactions were particularly impactful on academic performance, as summarised in Table 6.

	Social Themes	Sub themes
Familial	1.Loss of a family member	Hard to adapt and accept
	2.Feelings of loneliness, alienation and nostalgic	Prefer to be surrounded by family support
	3.Dysfunctional family: family that frustrates its children and discourages them from studying.	"hittin' the books ain't worth it"
	4.Unfavourable comparisons with other family members and friends.	Family desire to join the labour market
	5.Lack of understanding and underestimation of students' academic challenges	It's a shame and disgrace to seek a psychologist
Friends and Roommates	1.Personality traits and self-confidence	Easily influenced by outsiders
	2. Unfavourable influence to withdraw college and start a job.	Intimidation by the money
	3. Hard to make friends.	incidents of friend's mistrust
	4. Lack of social skills	Had to mingle and to ask for help
	5. Feelings of loneliness and a lack of close friendship	Introverts

Table 6: Social challenges perceived by students

A. Family

While some families offered strong emotional and academic support, others were unsympathetic. Several students reported being discouraged from seeking psychological help or continuing their studies. For instance, one participant's family labelled counselling as a "disgrace," and others viewed education as irrelevant, urging students to pursue employment instead. These attitudes led to emotional strain and reduced academic focus.

B. Friends and Roommates

Social networks functioned both as support systems and sources of distraction. Peer support groups, especially via messaging apps, were helpful for academic collaboration. However, several students reported negative influences from roommates and friends who encouraged excessive socialising and absenteeism. In some cases, a toxic environment of mistrust and isolation further undermined academic motivation.

4.2.3 Psychological Challenges

Students reported various psychological struggles, deeply intertwined with their educational and social experiences. Table 7 summarises key findings on psychological challenges.

No.	Psychological Themes	Sub Themes
1	Mental Stress and Obsession	preoccupation with their MTE scores.
2	Comparison with Peers	Comparing scores with classmates who have either passed or dropped out
3	Unrecognised Psychological Issues	struggle to attend exams due to unexplained anxiety or nervousness,
4	Depression and Loss of Passion	hopelessness, frustration, and a lack of motivation to attend classes or take exams.
5	Lack of Internal Motivation	find it difficult to defend themselves against external comments or judgments from others

Table 7: Psychological challenges perceived by students

A. Mental Stress and Academic Obsession

Mid-term exams (MTEs) were a major source of anxiety. Students became fixated on achieving high scores, and the constant pressure severely affected their mental health.

B. Peer Comparisons

Many students engaged in unhealthy comparisons with peers, particularly those who had passed or dropped out. These comparisons reinforced feelings of inadequacy and failure.

C. Unrecognised Psychological Conditions

Some students were unaware that psychological issues were affecting their performance. They reported skipping exams due to anxiety without fully understanding their mental state, which led to further academic decline.

D. Depression and Lack of Motivation

Although not formally diagnosed, depressive symptoms were evident in several interviews. Students described persistent sadness, loss of interest, and a sense of hopelessness about their academic future.

E. External Discouragement

Negative comments from peers or family members often eroded students' self-confidence. This external criticism compounded internal struggles and left students emotionally vulnerable.

F. Interconnected Stressors

Participants identified a chain reaction of academic, social, and personal pressures that collectively impacted their mental well-being. These interconnected challenges contributed significantly to academic probation.

4.2.4 Personal Challenges

In addition to educational, social, and psychological issues, students faced personal obstacles, as Table 8 summarises.

No.	Personal Themes	Sub themes
1	Health Issues:	serious illnesses and medical treatments
2	Carelessness and Procrastination:	Putting off assignments and studying until the last minute
3	Time Management	balance their coursework with other responsibilities and commitments.

Table 8: Personal challenges perceived by students

A. Health Issues

Some participants suffered from chronic illnesses or underwent medical treatments, which disrupted their academic progress due to missed lectures, exams, and deadlines.

B. Procrastination and Poor Study Habits

Others admitted to procrastination and a lack of attentiveness. Delaying assignments or exam preparation led to underperformance and increased stress.

C. Time Management

Poor time management was frequently cited. Students struggled to balance academic duties with personal commitments, often cramming at the end of the term with minimal understanding of the material.

One student summarised: "We leave everything until the end, then panic. How can we pass when we barely understand what we're studying?"

4.3 Answer to Question 2: *How Do the Risks Articulated by Students and Counselling Staff Demonstrate Interconnectedness?*

A comparison of student and staff perspectives revealed key differences, summarised in Table 9. Counselling staff focused primarily on surface-level or individual factors such as language skills, unfamiliarity with academic systems, and low confidence. In contrast, students emphasised institutional shortcomings, such as inflexible policies, unsupportive instructors, and academic pressures, as root causes of their struggles.

No.	Challenges	Consellers' perspectives	Sub-themes		Students' perspectives	Sub-themes
1	Educational	English language barrier	A hurdle to pass their math courses and their academic progress in particular	vs	Student-unit convenor relationship and support	E. Ill-consideration to students' individual circumstances F. Biased attitudes and lack of collaboration G. Exam needs and unfair attitudes H. Teachers' teaching methods and language barriers
		Lack of knowledge of the academic system	Students do not know that they are on probation		Long-term impacts of COVID-19 online education	A. Forms of assessment
					English language learning as a second language	A. Language spoken by expatriate teachers B. Exam questions hard to understand
					Overload study material	A. FE materials B. Difficulty of courses in advanced study levels
					IELTS band score requirements	A. Band requirement hard to achieve B. Expensive costs of the exam

Table 9: Difference in students' and counselling staff's perspectives on the perceived challenges of drop out (*continues on next pages*)

					Academic advisor challenges	A. Lack of communication
					GPA requirements for academic success	A. Hard to transition from one study level to the higher one
					Curve assessment system	A. Unjust final marks
					Hurdles in the major change process	A. Absence of career guidance
2	Social	1. Familial Family is experiencing financial difficulties The eldest are burdened with additional responsibilities Parents (or one of them) have previously grappled with psychological disorders or employed coercive and abusive parenting practices Consequences of immature relationships and family repercussions Forced withdrawal or early marriage Ill-treatment and abuse within the family Caregiving responsibilities: having to take care of other family members (e.g. elderly father; divorced sister; younger siblings) Pressure from parents to start working		vs	1. Familial Loss of a family member Feelings of loneliness, alienation and nostalgia Dysfunctional family; family that frustrates its children and discourages them from studying Unfavourable comparisons with other family members and friends Lack of understanding and underestimation of students' academic challenges 2. Friends and roomates Personality traits and self-confidence Unfavourable influence to withdraw college and start a job Hard to make friends Lack of social skills Feelings of loneliness and lack of close friendship	

3	Psychological	Fear of failure: leading to feelings of depression		vs	Mental stress and obsession Comparison with peers Unrecognised psychological issues Depression and loss of passion Lack of internal motivation	
		Spiritual emptiness: a lack of clarity in their life goals, a loss of passion, and a pervasive feeling of sadness for which they are unable to pinpoint the underlying causes				
4	Personal challenges	Desire for freedom and absolute independence University allowance does not satisfy students Concern about their future job prospects Religious misconceptions			Financial strain Health issues Carelessness and procrastination Time management	

Table 9: Difference in students' and counselling staff's perspectives on the perceived challenges of drop out

While both groups acknowledged psychological stress, students more clearly articulated how academic and social issues fed into mental health challenges. Counselling staff tended to focus on how students responded to difficulties, whereas students highlighted systemic issues that created those difficulties in the first place.

This divergence suggests a critical need for greater alignment between institutional support services and the realities students face. A more nuanced understanding of the interconnected academic, social, psychological, and personal risks is essential to developing effective interventions beyond surface-level remediation.

5. Discussion

This section discusses and situates the research findings within the broader body of literature on student dropout. Using a phenomenological lens, it critically examines how structural, institutional, and socio-cultural dynamics intersect to influence students' perceptions and lived experiences. The study identifies the key variables contributing to academic probation and dropout through comparative analysis, incorporating insights from both students and counselling staff. This integrative approach enables a holistic understanding of student attrition in the Omani higher education context.

5.1 Challenges Hindering Academic Progress for Omani Students on Probation

This study employed the five-tier conceptual schema of Brown et al. (2021), which identifies multifaceted barriers to educational access and attainment. These include: (1) individual dilemmas, (2) family conditions, (3) social interactions, (4) organisational characteristics, and (5) structural dimensions. Using this framework, the study categorised the challenges faced by students into four domains: Educational, Social, Psychological, and Personal.

5.1.1 Educational Challenges

A. Infrastructure and Support

Students reported significant gaps in institutional infrastructure and academic support. These included inadequate communication with lecturers, excessive course material, difficulties with academic advisors, and opaque GPA and assessment policies. Particularly concerning was the recurrent theme of student-instructor disconnect. Several students expressed frustration over their lecturers' lack of compassion and pedagogical engagement. This aligns with Tinto's (1993) theory, which emphasises the necessity of academic integration and institutional support in promoting student retention.

Notably, students criticised being taught by instructors from unrelated specialisations, resulting in perceptions of incompetence and diminished trust. While some staff may be multi-qualified, the university's lack of transparency further alienated students. These findings resonate with Bourdieu's (1977) theory of cultural capital, wherein hidden institutional norms disadvantage students from less privileged backgrounds. Enhanced faculty training in student-centred pedagogy and implementing structured mentorship programmes could address these shortcomings.

B. Pandemic-Related Challenges

The pandemic exacerbated academic vulnerabilities. Students cited struggles adapting to new assessment formats and perceived unfair grading practices introduced during remote learning. The decision to weight Mid-Term and Final Exams at 50% each added pressure, disproportionately affecting students on probation.

This finding supports international evidence from Brown et al. (2022), highlighting widening educational inequalities during the pandemic. Students in this study, however, emphasised assessment methods rather than technological barriers. This diverges from dominant narratives and suggests redesigning assessment frameworks to prioritise fairness and flexibility in future emergencies (St-Onge et al., 2022).

C. Language and Cultural Barriers

Language challenges were another critical concern. Students educated in Arabic-medium schools experienced difficulties transitioning to an English-dominated university environment. High-stakes requirements such as IELTS further compounded the stress. These findings reaffirm Bourdieu's (1977) argument that cultural capital significantly influences academic access.

Although Oman employs a bilingual education policy (Al Mahrooqi, 2018), students indicated that foundational English instruction was insufficient and overly reliant on foreign, culturally detached textbooks (Khattak et al., 2021). Recommendations include adopting contextualised English curricula, flexible assessment benchmarks, and enhanced language support services tailored to local realities.

5.1.2 Social Challenges

Social factors emerged as pivotal in shaping students' academic trajectories. Cultural norms in Oman emphasise family obligations, often prioritising them over individual ambitions. This can hinder academic focus and long-term educational planning. Students reported emotional and logistical burdens stemming from familial expectations, echoing findings by Swanson and Fouad (2014).

Some students described being discouraged by family members from pursuing university education, with preferences leaning towards early employment or military service. Others

Others struggled with the transition to independent living, lacking access to basic necessities or adequate social networks. This corresponds with literature highlighting the destabilising effect of socio-economic disparities on academic persistence (Lehmann, 2007).

Additionally, the stigma surrounding mental health issues in Omani society was found to inhibit help-seeking behaviours. Students facing emotional or psychological difficulties frequently choose to suffer in silence due to fear of shame or dishonour (Al-Alawi et al., 2016). Universities should therefore implement family-inclusive interventions and community-based awareness programmes to reduce stigma and improve support mechanisms.

5.1.3 Psychological Challenges

Mental health challenges were widely reported and included anxiety, stress, low self-esteem, and fear of failure. These were often linked to unsupportive teaching environments and familial pressure. Students internalised their academic struggles, reflecting a culture of self-blame that can obscure institutional accountability.

This confirms Porter's (1990) and Eisenberg et al.'s (2009) assertions that mental health is a decisive factor in student retention. Students also identified procrastination and poor time management as personal shortcomings, highlighting the complex interaction between internal traits and external pressures. Universities must normalise discussions of mental health, expand access to counselling services, and foster a more compassionate academic culture.

5.1.4 Personal Challenges

In addition to structural and psychological stressors, students also faced personal hardships, including chronic illness and limited institutional flexibility. Policies such as the debarment rule for exceeding 15% unexcused absences exacerbated student vulnerability. These issues underscore the need for a more flexible and supportive framework of academic policies. A holistic approach to student support should accommodate health-related absences and recognise the multifactorial nature of academic failure.

5.2 Similarities and Differences Between Student and Counselling Staff Perspectives

A significant finding was the disconnect between student and staff perceptions of the causes of academic probation. While students emphasised institutional shortcomings, especially regarding teaching quality and advisor support, counselling staff focused on student preparedness and motivation. In previous institutional reports, only two academic causes were cited by staff, whereas students identified nine. This disparity indicates that student perspectives provide a more granular and comprehensive account. Furthermore, issues such as negative student-teacher relationships were entirely overlooked by staff, despite being paramount in student narratives.

This gap highlights a lack of communication and trust between students and institutional representatives. While both students and staff acknowledged the influence of social pressures, students placed greater emphasis on cultural and emotional factors. A notable divergence was the concept of "spiritual emptiness" raised by counselling staff but absent from student accounts. Although it may reflect deeper existential concerns, its omission from student narratives requires careful interpretation. Addressing these divergences is essential for designing student-centred interventions. Institutions should validate student experiences, incorporate their voices in policy development, and establish open communication channels between students, faculty, and counselling services.

5.3 Implications of Findings in the Gulf Cooperation Council (GCC) Context

Although much research on student dropouts originates in Western contexts (Tinto, 1993; Yorke & Longden, 2004), the findings of this study align with broader trends across the Gulf Cooperation Council (GCC). Despite significant state investment in higher education, institutions in the GCC continue to report high dropout rates, particularly among male students (Gulf Research Centre, 2022). One major driver of this trend is the availability of lucrative job opportunities that do not require academic qualifications. This economic reality incentivises early workforce entry over prolonged academic engagement. It is important, therefore, for universities to better integrate career guidance with academic advising. Additionally, the COVID-19 pandemic exacerbated many of the challenges already present in the region's education systems. The rapid transition to remote learning disrupted student engagement and exposed systemic vulnerabilities (Al-Khalifa, 2020). Higher education institutions in the GCC must adopt comprehensive policies addressing academic and socio-economic barriers. These should include targeted financial support, adaptive teaching practices, career-aligned programmes, and investments in digital infrastructure. Only through such integrated strategies can institutions hope to reduce dropout rates and promote inclusive academic success.

6. Conclusion

This study employed a critical realist framework alongside a constructivist phenomenological case study design, enabling an in-depth exploration of probationary students' complex challenges. Employing a mixed-methods approach, semi-structured interviews yielded rich qualitative data, analysed through Braun and Clarke's thematic analysis and guided by the literature.

Findings revealed educational, psychological, social, and personal obstacles. Key themes included poor relationships with lecturers, limited institutional support, the lingering effects of COVID-19-related online learning, and inadequate English proficiency. Family pressures, peer influences, and academic stress further exacerbated students' psychological burdens, underscoring the interwoven nature of their challenges.

These insights have critical implications for policy. Universities should shift from punitive probation models to supportive, student-centred frameworks. Early interventions should be prioritised, such as tailored tutoring, academic advising, and increased lecturer engagement. Faculty development must promote inclusive, empathetic teaching practices. Support services should better align with student needs, ensuring accessible and responsive care. Preventative measures like peer mentoring, early warning systems, and academic coaching must be integrated into institutional strategies. Future research should evaluate the impact of mental health access on academic outcomes and explore structural reforms. A collaborative, holistic approach is vital to creating equitable probation systems that foster student resilience and success.

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BRIDGING THE GAP: ROBOTICS ADOPTION AND ORGANISATIONAL CHANGE IN UK HEALTHCARE

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Abstract

The National Health Service (NHS) is experiencing critical workforce shortages, with increasing patient demand, rising workloads, and financial constraints leading to staff burnout and job dissatisfaction. While robotic technology has been identified as a potential solution to alleviate these pressures, adoption has remained slow due to governance challenges, staff resistance, and a lack of structured implementation strategies. The NHS Long Term Plan recognises the role of robotics in reducing administrative burdens and enhancing workforce sustainability, yet many healthcare establishments face significant barriers to successful integration, particularly concerns about technological complexity, job displacement fears, and inadequate organisational support.

This article examines the impact of robotics on healthcare staff, with a focus on how organisational policies, workplace structures, and management practices must evolve to support successful technology adoption. It identifies a key gap in current research: the limited focus on adaptive change management (CM) strategies suited to the NHS context. While previous studies have emphasised technological readiness and ethical concerns, this study builds on prior work by synthesising interdisciplinary literature with conceptual insights from organisational theory. It explores why some healthcare establishments struggle to integrate robotics, identifying gaps in CM strategies, staff training, and institutional support that contribute to resistance. Additionally, it considers the wider socio-economic impact of robotics adoption, particularly in relation to job roles, skills development, and long-term workforce sustainability.

The discussion highlights the need for an iterative, adaptive approach to CM in complex healthcare environments. The Socio-Economic Approach to Management (SEAM) is proposed as an alternative approach to address organisational barriers, enhance staff engagement, and create a smoother transition toward robotics-assisted workflows. The article concludes by calling for future empirical studies to validate conceptual insights and evaluate the practical application of SEAM within healthcare settings.

Introduction

The integration of robotics into UK healthcare establishments represents a significant step toward modernising workflows and addressing workforce challenges. The healthcare sector has been under immense pressure due to increasing patient demand, chronic

workforce shortages, and financial constraints (Health Foundation, 2018; Shembavnekar et al., 2022). These challenges have led to higher workloads for healthcare professionals, resulting in burnout, which in turn affects performance and the quality of care, as staff work longer hours to protect patient welfare (Poghosyan et al., 2010). In response, technological advancements, particularly in robotics, have been proposed as a means to enhance workforce sustainability by automating routine tasks, optimising clinical workflows, and allowing healthcare professionals to handle the major healthcare concerns of the twenty-first century (Topol, 2019).

The introduction of robotics into healthcare dates back to the late 1980s, with the development of early robotic surgical systems such as the PUMA 560, which was used in a neurosurgical biopsy procedure (Singh et al., 2022). In the early 2000s, the da Vinci Surgical System became the first widely commercialised robotic platform, marking a significant milestone in robotic-assisted surgery (RAS) (Desai, Lin and Slomovitz, 2014). Since then robotic technology has demonstrated its potential in various healthcare applications, including automated pharmacy dispensing, logistics or delivery robots, disinfection robots, socially assistive robots (SAR) and rehabilitation robots (Sierra Marín et al., 2021; Morgan et al., 2022). Despite these advancements, the adoption of robotics in UK healthcare remains slow and inconsistent, hindered by multiple barriers such as technological complexity, job loss fears, and inadequate organisational support (Radic, Vosen and Graf, 2019; Papadopoulos et al., 2020). More recent attention has focused on barriers – from regulatory complexities to workforce apprehensions (Cresswell, Cunningham-Burley and Sheikh, 2018). Critically, the existing literature provides limited insights into how structured change management (CM) frameworks can systematically overcome these barriers within the UK's uniquely regulated and complex healthcare context. The lack of structured CM frameworks has been shown to exacerbate these challenges, leading to resistance among healthcare professionals and difficulties in integrating robotics into existing workflows (Imison et al., 2016). Addressing this gap in literature is vital, as understanding how effective CM strategies facilitate the integration of robotics can significantly improve healthcare institutions' abilities to overcome workforce resistance, regulatory complexities, and organisational barriers.

This article explores the evolving role of robotics in UK healthcare, focusing on its impact on healthcare staff, organisational barriers to adoption, and the need for structured CM strategies. It specifically addresses the critical gap by exploring structured CM approaches, particularly the Socioeconomic Approach to Management (SEAM), examining its potential to improve the adoption of robotic technologies while maintaining workforce stability and operational efficiency. By examining both the challenges and opportunities, this discussion provides insights into how healthcare institutions can navigate the transition toward robotics-assisted workflows while maintaining workforce stability and operational efficiency. A key consideration is how technology such as robotics can be successfully implemented in a way that enhances rather than disrupts existing roles within an institution (Cubric, 2020). Furthermore, this article critically evaluates governance and regulatory challenges, arguing

that clear policy frameworks and workforce engagement strategies are essential for sustainable robotics adoption in healthcare settings.

The article is structured into the following sections: it begins by introducing relevant technology adoption models to provide a theoretical foundation for understanding the conditions influencing technology adoption. It then examines the current landscape of robotics, focusing on adoption barriers and workforce concerns. Next, it discusses the role of the CM approach in the successful implementation of healthcare robotics. Finally, it explores the potential role of SEAM as a framework for adopting robotics in a complex setting like healthcare. In doing so, this article contributes to the broader discourse on healthcare technology adoption, workforce sustainability, and organisational CM.

Methodology

This article adopts a conceptual research design, grounded in a structured review of interdisciplinary literature drawn from health services research, organisational studies, and management science rather than the collection of new empirical data. In accordance with Jaakkola (2020) guidelines for conceptual articles, an integrative review approach was employed to collate, compare, and reconcile existing theoretical perspectives on organisational change, technology adoption, and healthcare innovation. The objective is to identify and critically analyse patterns, frameworks, and theoretical underpinnings that inform the adoption of robotics within complex healthcare environments.

To support this analysis, a review of peer-reviewed academic literature was conducted using three electronic bibliographic databases: PubMed, SCOPUS, and JSTOR. A broad range of search terms was employed to capture the interdisciplinary nature of the topic, including terms related to healthcare robotics, CM and pilot projects. The review was limited to English-language peer-reviewed articles and reviews published over the last decade, ensuring the discussion reflects recent trends and developments. All articles were imported and organised using Mendeley reference management software, where duplicates were removed and titles and abstracts screened for relevance.

Through integrating knowledge from existing empirical and theoretical sources, this article builds a foundation for understanding the conditions under which robotics may be successfully implemented in healthcare systems and how CM models can be adapted to support this transformation. By focusing on existing academic work, this study seeks to advance theoretical understanding rather than gather new data. The resulting framework, grounded in multiple established theories, offers a structured lens through which future empirical research can be designed. It is anticipated that subsequent studies will apply and test this conceptual model in real-world healthcare settings, enhancing its practical relevance and robustness.

Theoretical Perspectives on Technology Adoption in Healthcare

To understand the conditions that support or hinder robotics adoption, it is important to anchor the discussion within established theoretical frameworks of technology adoption. Several models have been developed to explain how individuals and organisations respond to new technologies, particularly in complex settings such as healthcare. One widely used model is the Technology Acceptance Model (TAM), developed by Davis (1989), which suggests that perceived usefulness and perceived ease of use are the primary drivers influencing whether individuals accept and use a new technology. TAM has been applied extensively in healthcare to understand professional attitudes toward innovations such as electronic health records and robotic surgery tools. Building on TAM, the Unified Theory of Acceptance and Use of Technology (UTAUT) developed by Venkatesh et al. (2003) introduces additional constructs such as performance expectancy, effort expectancy, social influence, and facilitating conditions. This model has proven useful in accounting for organisational, cultural, and infrastructural factors affecting adoption decisions, particularly relevant to the NHS context. Another relevant framework is Rogers' (2014) Diffusion of Innovations (DoI) Theory, which identifies key attributes influencing the spread of innovation: relative advantage, compatibility, complexity, trialability, and observability. These concepts provide a helpful lens for evaluating both individual and organisational readiness for robotics, as well as explaining the varied pace of adoption observed across healthcare systems.

In the context of this study, these models offer valuable conceptual tools to interpret why robotics adoption may succeed or fail. For instance, perceived complexity and lack of observable benefits may generate resistance among staff, while strong leadership (a facilitating condition in UTAUT) and opportunities to trial the technology (trialability in DoI) can help overcome these barriers. These insights also align with the CM strategies discussed in this paper, reinforcing the importance of addressing both individual and systemic factors in planning for successful adoption.

Challenges of Adopting Robotics in UK Healthcare

The adoption of robotics in UK healthcare faces significant barriers, slowing its implementation. This slow and uneven adoption may be attributed to significant sociotechnical challenges (Reid and Norell, 2024). A major challenge in adopting robotics is integrating the technology into an already complex healthcare system. Robotic systems need careful calibration, precise control, and seamless integration with existing digital systems like electronic health records (EHRs) and hospital management platforms (Radic, Vosen and Graf, 2019). The lack of standardisation across different robotic platforms further complicates implementation, as healthcare establishments must navigate compatibility issues, interoperability challenges, and maintenance requirements. Additionally, training

healthcare professionals to operate and troubleshoot robotic systems require significant time and financial investment, which many institutions struggle to accommodate (Papadopoulos et al., 2020). Beyond these logistical and technical challenges, there is also the issue of limited research on long-term efficacy and safety, leading to uncertainty among clinicians and administrators regarding the sustained benefits of robotic integration (Servaty et al., 2020). Despite these challenges, emerging robotic technologies hold promise for improving the safety, quality, and efficiency of healthcare delivery (Cresswell, Cunningham-Burley and Sheikh, 2018).

This section critically examines four key challenges in the UK healthcare context: (1) the complexity of integrating robots into a highly intricate, regulated system; (2) concerns over job loss and impacts on healthcare professionals' roles; (3) workforce resistance rooted in cultural and psychological factors; and (4) lack of organisational support manifesting as gaps in training, funding, and strategic implementation. Each barrier is discussed with the hope of adding to the conversation of how these challenges may be addressed to realise robotics' full benefits in patient care.

Integration Complexity in a Regulated Healthcare System

Implementing robotic technology in healthcare is inherently complex due to the sector's intricacy and stringent regulation. Healthcare involves interconnected processes, legacy infrastructure, and strict patient safety requirements, making technical integration challenging. For example, introducing a surgical robot entails not only installing new equipment but also significant reengineering of workflows and clinical processes, which can be highly disruptive (Louisa Lawrie et al., 2022). Team-based training programmes, which include both technical training and the development of new workflow processes, are critical to ensuring the successful adoption of RAS systems (Randell et al., 2019). Furthermore, the engagement of stakeholders, particularly the surgeons who will be using the technology, is crucial. These stakeholders need to be involved from the early stages to address any resistance and ensure their buy-in, which is essential for successful implementation (Louisa Lawrie et al., 2022). For SARs, integration efforts often focus on creating a supportive environment that facilitates the acceptance of the robots by both patients and care givers. This often involves extensive communication strategies to educate and inform staff and patients about the benefits of SARs, as well as pilot programmes that allow stakeholders to interact with the robots in a controlled setting before full-scale implementation (Koh et al., 2023). This underscores that robotics adoption is not a simple plug-and-play upgrade; it must mesh with complex care pathways and often necessitates redesigning how work is done.

Regulatory and policy barriers further complicate integration. Healthcare robots often fall under medical device regulations and clinical governance rules that were not originally designed with autonomous or Artificial Intelligence (AI)-driven systems in mind. Moreover, the shift from the Medical Devices Directive (MDD) to the more stringent Medical Devices

Regulation (MDR), alongside Brexit and the global pandemic, has reshaped the regulatory landscape (Bergeles et al., 2021). Rigid regulatory approval processes can slow down innovation, while gaps or ambiguities in regulation create uncertainty for developers and adopters (Reid and Norell, 2024). For example, current healthcare AI faces challenges with sorting errors due to inaccurate labelling. Modern surgical robots, like the Da Vinci, rely on teleoperation technology, which translates human inputs into minimally invasive microsurgical actions. Therefore, they lack true autonomy, making the autonomy-suggesting label misleading (Terry, 2019). Even with reforms like Integrated Care Systems, stakeholders still cite bureaucratic procurement frameworks and a lack of unified standards as obstacles to scaling new technologies (ABHI, 2024). Consequently, integrating robots into such a complex, regulated system requires not only technological readiness but also regulatory agility and system-wide coordination – areas where the UK healthcare system has historically struggled.

Despite these challenges, it is worth noting that not all robotic applications in healthcare face equal integration hurdles. Robots confined to controlled, well-defined tasks (such as pharmacy dispensing or logistics robots) tend to present fewer sociotechnical challenges and have seen quicker uptake (Cresswell, Cunningham-Burley and Sheikh, 2018). Logistics and pharmacy dispensing robots automate the transportation of supplies and medications within healthcare facilities. Therefore, implementation efforts for these types of robots often focus on operational integration or process optimisation, such as mapping out the existing workflows, identifying bottlenecks, and redesigning processes to accommodate the new technology (Benzidia et al., 2019). Failure to optimise these processes often leads to challenges, with robots failing to meet their expected performance levels, leading to disruptions in daily operations (Servaty et al., 2020). While these robots do not directly interact with patients, their successful implementation can significantly improve operational efficiency. In contrast, autonomous patient-facing robots (like SARs or RAS) blur the line between social and technical domains and thus encounter far greater resistance and regulatory scrutiny (Cresswell, Cunningham-Burley and Sheikh, 2018). For instance, healthcare institutions that neglected investments in training and stakeholder engagement often faced challenges such as underutilisation of the technology or even outright rejection by the surgical staff (Hogan-Murphy et al., 2021). Conversely, those that invested in these areas reported higher levels of adoption and satisfaction with the technology (Compagni, Mele and Ravasi, 2015). This suggests that the complexity of integration is proportional to a robot's level of autonomy and its proximity to direct patient care.

A comparative perspective also highlights that other countries sometimes outpace the UK by streamlining regulations for healthcare robotics – for example, Japan and South Korea have national strategies and standards for care robots, whereas the UK's approach has been more cautious and piecemeal (Kodate et al., 2022). Japan has proactively integrated robotic technologies into nursing home care to address labour shortages and improve care quality. Robot adoption in Japanese nursing homes is associated with improved job retention, reduced physical burden on care givers, and enhanced care quality (Shorenstein

APARC, 2023). South Korea, similarly, has implemented coordinated national strategies and regulatory frameworks that support innovation in care robotics, contributing to accelerated adoption (Collins, 2023).

Italy presents a different but instructive example. A multilevel study by Compagni, Mele and Ravasi (2015) found that the adoption of robotic surgery was significantly influenced by early adopters (experienced surgeons) who played a critical role in promoting the technology's legitimacy and effectiveness within the medical community. These clinical champions acted as opinion leaders, encouraging other institutions to follow suit. In the United States, professional networks and inter-organisational collaborations have been identified as key drivers of adoption. Iacopino et al. (2017) demonstrated that hospitals embedded in strong collaborative networks were more likely to implement robotic surgical systems, reflecting the power of peer influence and knowledge sharing.

Ultimately, the UK's highly intricate and rule-bound healthcare environment poses a substantial barrier to robotics adoption, demanding careful alignment of technology with policy and proactive efforts to update regulatory frameworks alongside the introduction of robotic innovations.

Impact on Healthcare Professionals' Roles and Responsibilities

A major concern about healthcare robotics is the fear that they may replace certain jobs (Qureshi and Syed, 2014). In the UK, where the NHS is a major employer and healthcare professionals are already stretched thin, talk of automation can provoke anxiety about job security and professional identity (Elendu et al., 2023). Support staff fear job losses if robots take over routine tasks like portering, cleaning, and basic monitoring (Price, 2019). While automation has reduced jobs in other industries, healthcare roles are highly skilled and relational, making full replacement less likely. For example, the demand for physical and manual skills in the healthcare sector is expected to increase by 2030, driven by the necessity for gross motor skills and strength in roles such as elder care and physical therapy, as well as the fine motor skills essential for registered nurses (Bughin et al., 2018). Moreover, some research has actually shown healthcare workers' workloads being lessened by robotics, freeing them up to concentrate on more difficult jobs requiring human expertise (Said et al., 2020; Céspedes et al., 2021). Notwithstanding, professional bodies have voiced concerns about the adoption of robotics, fearing it could put members out of work, as one early case illustrated: a company introduced a robotic anaesthesiology system that worked well technically and was cost-effective, yet it was abandoned due to intense pushback from doctors' and patients' groups worried about job loss and safety (Terry, 2019). This example highlights how even a well-functioning robotic solution can fail if it threatens professional roles without buy-in from those affected.

Critically, however, the narrative of robots replacing humans often oversimplifies reality. In practice, many healthcare robots are designed to augment human work, taking over menial

or strenuous tasks and freeing clinicians for more complex patient care duties (Ergin et al., 2023). For example, surgical robots, like the Da Vinci system, still require skilled surgeons at the console, and rather than eliminating the surgeon's role, they enhance precision and may reduce the likelihood of human error and surgeon fatigue (Chatterjee et al., 2024; Silvera-Tawil, 2024). The NHS has significant workforce shortages in areas like nursing and aged care (Health Foundation, 2018). The strategic use of robots could alleviate workload rather than cause redundancies by taking over tasks that staff find physically taxing or time-consuming (e.g. lifting patients or delivering supplies) (Radic, Vosen and Graf, 2019). In care homes where staff were properly trained and patients were gradually introduced to SARs, there was a marked improvement in patient outcomes, including reduced anxiety and improved mood (Bradwell et al., 2022). The critical challenge, then, is perception and management: if staff see robotics as a threat, the implementation will face challenges, but if they are engaged and reassured that robots will be assistive tools to improve their working conditions and patient outcomes, resistance may soften. This form of resistance is seen to come from a lack of understanding and lack of communication about the benefits and processes involved in implementation (Mekanontchai, 2009). Therefore, addressing concerns about job loss requires transparent communication, involvement of professionals in implementation, and evidence that robots can enhance rather than diminish healthcare roles.

Workforce Resistance: Psychological and Cultural Barriers

In addition to job loss fears, psychological and cultural factors contribute to workforce resistance. In the NHS – as in many Western healthcare systems – there is an entrenched culture of traditional practice and a high value placed on human interaction in care (Allen et al., 2024). Robots, especially those that interact with patients, challenge deep-rooted notions of caregiving, empathy, and professional identity. Healthcare staff and patients may feel uneasy about robotic technology, even without job security concerns (Wu et al., 2014). Negative media portrayals and science fiction stereotypes can create scepticism, showing the adoption of robotics in healthcare (Papadopoulos et al., 2020; Solberg and Kirchhoff, 2024). Moreover, other studies demonstrated that attitudes towards robotic applications in healthcare may also vary significantly based on factors such as education level, age, professional role, and even spoken language. For example, a study showed that individuals whose mother tongue is Finnish are more likely to hold negative perceptions of humanoid robots compared to those whose first language is Swedish (Andtfolk et al., 2022). Some staff have formed unfavourable opinions of robots largely attributed to previously mentioned concerns about robots posing a perceived threat to their job security (Dolic, Castro and Moarcas, 2019). Other studies have shown that negative stereotypes in science fiction have also been observed to reinforce biases and shape people's perceptions of robotics, with some participants believing that robots may kill or even dominate every human being on the planet (Bo, Ma'rof and Zaremohzzabieh, 2025). Such visceral reactions illustrate a psychological barrier: distrust in robots' safety and a concern that they lack compassion or could malfunction with dire consequences.

Cultural perceptions and familiarity also play a significant role in acceptance. The UK public and workforce generally have had limited direct exposure to robots in everyday life, especially in care contexts, which breeds a fear of the unknown. A study observed that individuals from marginalised or at-risk groups, particularly those more likely to experience healthcare disparities, tend to be less optimistic about the potential impact of technology compared to those less affected by such inequalities (Binesmael et al., 2024). By contrast, in countries like Japan, cultural narratives often depict robots positively – some even attribute lifelike qualities or a soul to robots – leading to greater openness to robotic care givers (Castelo and Sarvary, 2022). This East-West contrast, Japanese acceptance vs. British skepticism, underscores that cultural norms and societal narratives influence how healthcare robotics are received. UK healthcare professionals may thus be culturally predisposed to question the suitability of robots in roles that involve empathy, communication, or complex decision-making, preferring human judgement in these domains.

Another facet of workforce resistance is the psychological impact of change. Introducing robots can disrupt team dynamics and routines, causing anxiety about how work relationships and responsibilities will shift. For instance, successful implementation of rehabilitation robots often hinges on individualised training and the involvement of multidisciplinary teams in the planning and execution phases. Physiotherapists, doctors, and nurses need to work together to ensure that the robotic interventions are tailored to the specific needs of each patient (Klaic et al., 2022). Some clinicians might feel a loss of control or professional autonomy when a machine takes over tasks they used to perform, raising serious concerns about dehumanisation, as robots are unlikely to become moral agents capable of maintaining human relations (Gibelli et al., 2021; Elendu et al., 2023).

There can also be a confidence gap: staff unsure of how to interact with or supervise a robot might distrust its outputs or hesitate to use it, especially if they are not adequately trained in its operation. Healthcare staff need to trust that these robots will function consistently, particularly in critical care situations. As such, robust training and technical support systems are essential components (Becevic et al., 2015). Indeed, lack of hands-on experience with robotics was cited as a major barrier to developing positive attitudes among both healthcare workers and patients (Randell et al., 2019). In pilots where staff were given time to work with new robotic tools (for instance, when provided with ongoing technical support and frequent feedback loops between users and IT teams), reports suggest that initial scepticism can give way to cautious acceptance once the technology proves reliable and helpful (Caleb-Solly et al., 2018). To overcome psychological and cultural barriers, experts recommend engaging frontline staff early, providing education and training, and showcasing successful use cases to dispel myths. Thus, workforce resistance, which is rooted in cultural values of care and fear of the unfamiliar, remains a critical barrier. Addressing it requires not just technical training but also cultural CM, ensuring that healthcare professionals feel psychologically safe and even empowered when robotics are introduced into their work environment.

Lack of Organisational Support and Change Management

Successful robotics adoption in healthcare requires strong organisational support and effective CM. In the UK, many attempts to introduce robotics have stumbled due to insufficient backing in terms of staff training, sustainable funding, and strategic implementation planning (Hogan-Murphy et al., 2021). Therefore, the benefits of technology become difficult to realise because they are often just added to existing systems without a firm change strategy (Imison et al., 2016). Thus, to fully reap the rewards of technology implementation, effective managerial leadership, organisational development, and CM are required. These factors are often interrelated and can create a vicious cycle: without clear strategy and funding, proper training programmes are not developed; without training, staff don't use the robots effectively, leading to poor outcomes that then undermine the case for further funding or scaling (Becevic et al., 2015; Isabet et al., 2021). A critical analysis must therefore consider how NHS organisations and leadership have supported (or failed to support) robotics initiatives.

Training and skills development are a foremost concern. Advanced robotic systems require clinicians and support staff to learn new skills – from operating and troubleshooting machines to integrating them into clinical decision-making. However, traditional medical and nursing curricula have only recently begun to include content on digital health and robotics, which means the current workforce often needs retraining to confidently work with robots (L. Lawrie et al., 2022). A systematic review of AI and tech adoption barriers found that education and training of the healthcare workforce is a significant barrier highlighted in numerous studies (Lawrie et al., 2022). In practice, when NHS hospitals acquire, a surgical robot, they frequently rely on the manufacturer to provide initial training to a handful of surgeons and technicians. For example, the Swansea Bay University Health Board noted that, in addition to the support and training provided by the manufacturer, they utilised simulators to enhance the learning process (Swansea Bay University Health Board, n.d.). Another study conducted by Klaic et al. (2022) aimed to investigate the willingness of physicians to use robots in rehabilitation. The findings indicated that training and embedded support are not consistently provided, indicating a discrepancy between the existing implementation and the educational requirements of rehabilitation professionals. The absence of comprehensive, ongoing training programmes can leave staff feeling unprepared and unsupported (Noe, 2005). For example, team-based training programmes, which include both technical training and the development of new workflow processes, have been shown to be critical to ensuring the successful adoption of RAS systems (Randell et al., 2019). Recognising this gap, policymakers commissioned the Topol Review (2019) to advise on preparing the NHS workforce for digital futures; among its aims was to determine how tens of thousands of NHS staff can be trained to use robotics so that they are equipped to deliver modern care. The Topol Review's recommendations stressed continuous professional development in digital skills and the creation of multi-disciplinary learning collaboratives in every NHS organisation (Topol, 2019). While progress is being made, a lack of organised training pathways still hinders many robotics projects (RCS England, 2023). Without

dedicated time and resources for staff to upskill, even well-funded robotic systems may languish due to workforce skill deficits.

Closely linked to training is the issue of funding and economic support. Robotic technologies often involve high upfront costs (for purchasing equipment) and ongoing expenses (maintenance, software updates, consumables) (Robillard and Kabacińska, 2020). In a healthcare system under financial strain, finding a budget for expensive robots can be difficult, and many NHS Trusts struggle to justify the investment unless there is clear evidence of cost-effectiveness. Thus, healthcare organisations only provide the necessary support when it economic sense to (De Vries et al., 2020). A scoping review identified inadequate resource allocation and costs of robotic equipment as major barriers to adoption (Hung et al., 2019). For example, a state-of-the-art surgical robot can cost well over £1 million, with annual maintenance running into tens of thousands – a steep price if the utilisation rate is low (Feldstein et al., 2019). Indeed, hospital managers are wary that a robot which is used infrequently (perhaps only by a small team or for niche cases) will fail to deliver a return on investment, effectively diverting funds from other patient services. To address this, some hospitals decide to lease the robots if they have a substantial volume of patients (Edlin et al., 2014). However, this creates a funding dilemma: to prove cost-effectiveness, the robot must be widely used, but to enable wide use, a hospital must spend more on training more staff, hiring additional personnel to run the robot in more shifts, etc., which requires more funding (Lai et al., 2025). In the UK, some funding support has come from central initiatives or charities for pilot projects, but scaling up often falls to local budgets. The absence of dedicated funding streams or incentives for innovation in NHS commissioning has been noted as a barrier to adopting cutting-edge technologies broadly.

Finally, the strategic implementation, or lack thereof, plays a pivotal role. Robotics adoption should align with a clear strategy that considers long-term integration into service delivery (Beedholm et al., 2015; Koh et al., 2023). However, some healthcare organisations have sometimes pursued robotics in an ad hoc manner – for instance, a study analysing two pilot project services found that, despite the potential to provide continuous and integrated patient care, pilot projects often face challenges leading to non-adoption or abandonment (Sacchi et al., 2023). These challenges include a lack of alignment with existing workflows, insufficient organisational support, and the absence of strategies for scaling beyond the pilot phase. An implementation study emphasises that the factors affecting robotics implementation are multi-faceted and evolve over time, and thus optimisation strategies need planning from the outset (Dyas et al., 2023). In other words, successful adoption requires upfront planning through each phase: preparing the ground (ensuring evidence, approvals, and staff buy-in), early implementation (training, workflow redesign, and troubleshooting), and sustainability (continuous evaluation, maintenance, and iterative improvement). The NHS has acknowledged its weakness in this regard; past reports note that the health service has suffered from a series of short-term projects and approaches, repeatedly identifying the same barriers over decades, and calls for a more consistent long-term strategy with clear accountability and resources for innovation adoption (NHS England,

2024).

Without strong leadership and commitment, robotics integration may fail, even with the best intentions (Lehmann et al., 2016). Therefore, if hospital executives do not prioritise a robotics programme, it may lack funding for maintenance or replacement after initial excitement wanes, or if there is no strategic mandate or communication of a clear vision, a busy clinical team might revert to traditional methods, especially under pressure.

To improve clarity and support cross-comparison, Table 1 summarises the main categories of adoption barriers and links them to corresponding CM strategies.

Category	Barrier	Change Management Strategy
Workforce Resistance	Fear of job displacement, skill mismatch	Training, role redefinition, engagement through Kotter's coalition step
Organisational Inertia	Lack of leadership, poor strategic alignment	Use of SEAM to uncover hidden costs and develop internal buy-in
Regulatory Complexity	Misalignment between innovation and policy	Policy co-design, agile governance frameworks
Technological Usability	Perceived complexity, lack of trial opportunities	Pilot programmes, user-centred design iterations
Cultural Barriers	Distrust in robotics, negative portrayal in media	Awareness campaigns, stakeholder education, public engagement

Table 1. Barriers to Healthcare Robotics Adoption and Corresponding CM Strategies

Change Management Approaches for Successful Healthcare Robotics Implementation

Robotics can improve healthcare efficiency, safety, and care quality (Vermeersch, Sampsel and Kleman, 2015). For example, service robots in hospitals can help prevent infections, reduce human errors, and free up staff for other tasks, ultimately enhancing care quality and effectiveness (Rojas and Tuomi, 2024). However, success depends on how well people and processes adapt to the change. Research on technology adoption emphasises that the key to achieving desired outcomes is getting people to embrace and adapt to the change (Marlicz et al., 2020). In practice, many healthcare innovations underdeliver because of resistance, workflow mismatches, or poor integration into the complex healthcare environment (Servaty et al., 2020). Effective CM is therefore critical for the successful implementation of healthcare robotics. Additional studies have examined factors that facilitate the adoption of robotic technology within selected healthcare contexts (Desai, Lin and Slomovitz, 2014; Louisa Lawrie et al., 2022). Kho, Gillespie and Martin-Khan (2020) have explored the impact of CM strategies on effective implementation. Achieving successful CM within healthcare requires the implementation of a comprehensive framework involving leadership support, training programmes, support, timely data feedback, and well-

defined incentives (Fryefield et al., 2014). Adding a technology aspect to the concerns of the change does not upend this idea; rather, successful integration becomes about combining technological and people-orientated solutions (Al-Abri, 2007). Complex settings like healthcare establishments with a reputation for being bureaucratic and hierarchical are less adaptable, less open to change, and less likely to give their employees more control (Steiner, 2001). This implies organisational factors not only affect the change culture but also the adoption of technology.

This section reviews established CM models used in healthcare, namely Kotter's 8-Step model (Kotter, 2009), Lewin's 3-Stage model (Lewin, 1951), and Prosci's ADKAR model (Hiatt, 2006) and discusses their applicability to robotics adoption. These models guide healthcare organisations in strategically implementing and sustaining evidence-based interventions, aiming at bridging the gap between recommendations and actual delivery (Harrison et al., 2021). However, there is no consensus on the role of CM as a tool or crucial factor in implementation, resulting in gaps in the literature regarding the current use and effectiveness of CM models in complex adaptive healthcare systems (Le-Dao et al., 2020).

The section concludes by examining the need for iterative and emergent strategies, given the complex, adaptive nature of healthcare, and lays the groundwork for exploring the Socioeconomic Approach to Management (SEAM) (Savall, 2003b) as a framework for guiding such change.

Kotter's 8-Step Change Model in Healthcare

One of the most widely referenced change frameworks is John Kotter's 8-step model for leading change. Originating in business, Kotter's model has been applied to numerous healthcare initiatives to provide a structured, stepwise roadmap for implementation (Campbell, 2008). Each step of the model addresses both the rational and emotional aspects of change, from motivating stakeholders to institutionalising new practices (Kotter and Schlesinger, 1989). In healthcare settings, Kotter's approach has been used to guide transformations such as electronic health record rollouts, process improvements, and AI integration (Arabi et al., 2022; Alrabie, 2023). By creating urgency around patient safety or quality improvement and building coalitions of clinicians and executives, hospitals have leveraged Kotter's steps to overcome inertia and resistance. Its emphasis on leadership alignment and communicating a clear vision is highly applicable to robotics adoption (Catchpole et al., 2022): implementing robots requires strong executive sponsorship and a assigning of coordinating roles to drive the adoption of the robot (Caleb-Solly et al., 2018). The model's focus on leadership and a top-to-bottom change paradigm helps to address individuals' scepticism regarding management's ability to implement change effectively. This, often referred to as cynicism about organisational change, can undermine the success of organisational transformation efforts, potentially impeding adoption and long-term sustainability (Miller, 2001). The final step, of sustaining momentum, is also crucial, as early positive examples—such as sustaining a strategy that prioritises adaptability—are crucial for

ensuring flexibility and responsiveness to the evolving needs, preferences, and contexts of both staff and residents and can build a lasting and sustainable culture of adoption (Koh et al., 2023). Overall, Kotter's model provides a systematic framework that can help healthcare organisations manage the large-scale organisational shifts that robotics implementation entails.

Lewin's Three-Stage Change Model

Kurt Lewin's classic change model is another foundational framework frequently cited in healthcare management. Lewin conceptualises change in three phases: Unfreeze! Change! refreeze! (Stanz et al., 2022). Lewin's model, though developed in the mid-20th century, fits well with healthcare changes due to its iterative feedback-orientated nature. It underscores the importance of preparation and reinforcement, which resonate with the way hospitals implement new protocols or technologies. For instance, when integrating a surgical robot into an operating room, the unfreeze stage would involve creating awareness of why the change is needed (e.g., higher precision, fewer complications) and addressing staff anxieties. The change stage would include hands-on training with the robot and gradual incorporation of robotic procedures. The refreeze stage would ensure that standard operating procedures and team roles are updated to include the robot, and successes are communicated to make the new process stick. Lewin's framework provides a high-level mental model to ensure a change is thoroughly prepared and institutionalised. However, one critique is that the model assumes a relatively stable end state refreeze, which can be challenging in modern healthcare environments where continuous improvement and new innovations arrive frequently (Cummings, Bridgman and Brown, 2016). This is unlikely during a transformational change, like that in a complex setting like healthcare, which sees the emergence of an entirely new state prompted by a shift in what is considered possible or necessary, which results in a profoundly different structure, culture, or level of performance (Dougall, Lewis and Ross, 2018). In the context of healthcare robotics—which will likely evolve through iterations and upgrades—leaders may find themselves repeatedly cycling through unfreezing and changing as technologies and workflows adapt. Thus, while Lewin's model offers valuable insight into the human side of change, it may need to be applied flexibly rather than as a one-off sequence in a complex healthcare setting.

Prosci ADKAR Model

Unlike Kotter's organisational-level roadmap or Lewin's big-picture stages, the Prosci ADKAR model focuses on the individual level of change. ADKAR is an acronym for the five outcomes a person needs to achieve for a change to be successful: Awareness of the need for change, Desire to participate in and support the change, Knowledge of how to change, Ability to implement new skills and behaviours, and Reinforcement to sustain the change (Kaminski, 2022). This model provides a structured way to identify and address gaps in each stage of an individual's change journey. For instance, if a hospital is deploying autonomous delivery robots, staff might initially lack awareness of why this change is happening. Building

awareness through communication about the benefits, such as reducing nurses' workload for routine errands. The desire, which is addressing concerns, perhaps by involving staff in planning how the robot will assist them, is the first critical step. Only then will training to gain knowledge and ability be truly effective, and ongoing support (reinforcement) ensure lasting adoption.

In practice, healthcare leaders have successfully applied ADKAR to technology implementations and process changes. A recent example saw nurse executives use the ADKAR framework to rapidly change care delivery models during the COVID-19 pandemic, underscoring that change must be managed through the use of a change model, such as ADKAR, to guide the process (Balluck, Asturi and Brockman, 2020). The strength of ADKAR in a healthcare robotics context lies in its attention to frontline staff's mindset and readiness. Robotics introduction can trigger fears about job roles or patient care quality (Vermeersch, Sampsel and Kleman, 2015); ADKAR's Awareness and Desire stages help surface and address these human factors early. Likewise, the Ability and Reinforcement stages ensure that even after initial training, staff receive enough practice and encouragement to incorporate the robot into daily routines. By tracking individual progress through these stages, managers can tailor interventions such as extra training, change champions, and incentives to areas of need. ADKAR thus complements broader organisational change plans by zeroing in on stakeholder engagement and adoption at the human level – a crucial element for high-technology changes like robotics where user acceptance can make or break the project.

Iterative and Emergent Change in a Complex Healthcare Environment

While the established models above provide valuable frameworks, healthcare is a complex, adaptive environment where change often does not follow a neat linear trajectory (Khan et al., 2018). Hospitals are characterised by interdependent processes, diverse professional groups, strict regulations, and high uncertainty. Implementing robotics is not a one-time technical installation—it triggers ongoing adjustments in workflows, team dynamics, and even organisational culture. Thus, CM in this domain must be iterative and responsive, accommodating emergent issues and feedback rather than rigidly sticking to a predetermined plan (Harrison et al., 2021). Indeed, scholars note that no single change model can fit all change initiatives, and change is “not a linear and straightforward process but rather an iterative and intricate one (Bamford and Forrester, 2003; Burnes, 2004). Particularly for technology-driven changes in socio-technical systems like healthcare, a more agile approach is needed. For example, one study on hospital service robots observed that traditional models are helpful as a starting point; however, it remains unclear how to handle specific complexities such as mismatches between the robot's capabilities and staff expectations or integrating the robot into existing routines (Rojas and Tuomi, 2024). These unforeseen challenges require adaptation and learning-by-doing during implementation.

Crucially, an emergent approach does not imply abandoning the structure of models like

Kotter or ADKAR but rather augmenting them with flexibility (Lazuardi and Muhyi, 2021). For instance, Kotter's framework can be executed in iterative waves—establish urgency, implement a small win, then re-establish urgency for the next phase. Likewise, ADKAR assessments can be repeated at intervals to gauge progress and new barriers. The goal is to acknowledge that the absence of a one-size-fits-all model necessitates a shift towards iterative, data-informed approaches and collaborative efforts. Healthcare organisations should be prepared to adjust their CM strategy as new information and conditions unfold.

From Framework to Practice: Case Studies in Change-Driven Robotics Adoption

To complement the theoretical discussion of CM strategies, it is important to draw on empirical examples that demonstrate how structured change processes have supported the integration of robotics in healthcare settings. A growing body of pilot studies and case-based research provides practical insights into how implementation challenges can be mitigated when appropriate CM interventions are applied.

For example, Vermeersch, Sampsel and Kleman (2015) conducted a pilot evaluation of a telepresence robot within geriatric primary care. Their findings underscore the value of involving caregiving staff from the outset, ensuring sustained engagement throughout the implementation process. This mirrors key principles from Kotter's model, specifically the importance of establishing a guiding coalition and fostering early buy-in. Bradwell et al. (2022) present a particularly relevant UK-based example, where socially assistive pet robots were introduced in care homes prior to and during the COVID-19 pandemic. The study identified clear enablers of adoption, including strong stakeholder engagement, staff training, and the alignment of technology with existing care practices. The change process was iterative and responsive to feedback, key characteristics of adaptive CM in complex environments. Further support for structured implementation comes from Gilardi et al. (2020), who evaluated robotic neurorehabilitation in a paediatric hospital in Italy. Their pilot study incorporated a human factors approach, demonstrating how anticipatory planning and integration of support mechanisms can smooth the transition into clinical practice and reduce resistance among healthcare professionals.

A further illustrative example comes from the FriWalk robotic walker pilot study by Pérez-Rodríguez et al. (2019), which assessed the usability, acceptance, and user experience of a smart mobility support robot in a real healthcare environment. The implementation process was characterised by ongoing feedback from both clinicians and older adult users, with multiple design iterations introduced during the pilot phase to refine functionality. This iterative, user-led approach reflects the core principles of emergent CM, where outcomes evolve through continuous learning and responsiveness to context-specific challenges. Rather than applying a predetermined sequence of change steps, the FriWalk project demonstrates the value of embedding flexible, adaptive mechanisms within the change process itself, particularly in settings where technological adoption intersects with complex human factors.

Collectively, these case studies provide empirical support for the theoretical argument that CM frameworks, when operationalised effectively, play a pivotal role in supporting the successful adoption of healthcare robotics. They also highlight the significance of tailoring implementation efforts to local context, culture, and professional dynamics, rather than assuming one-size-fits-all solutions.

Toward a Socioeconomic Approach to Change Management (SEAM)

Given the complexity of healthcare and the need for social, technical and economic alignment in robotics initiatives, some healthcare institutions are looking beyond traditional change models to more holistic frameworks. One such comprehensive approach is SEAM. SEAM, developed by Henri Savall and Véronique Zardet, is a qualitative and quantitative framework aimed at enhancing organisational efficiency. Unlike traditional management models that primarily emphasise financial metrics, SEAM integrates social and economic dimensions to provide a holistic analysis of organisational performance (Savall and Zardet, 2008). Rather than addressing only isolated pieces of the change (e.g., just technology or just people training), SEAM seeks to surface underlying organisational dysfunctions, hidden costs, and cultural elements that could impede change (Boje and Rosile, 2003). This approach involves deep diagnosis and engaging employees at all levels in identifying problems and crafting solutions, thus treating change as an ongoing collaborative process (Péron and Péron, 2003). Studies have shown that SEAM interventions in healthcare can diagnose dysfunction in an innovative and holistic manner while providing practical solutions and helping internal actors develop CM skills suited to their context (Hazim, 2017). In other words, SEAM not only helps implement a given change, such as a new robotic system, but also strengthens the organisation's capacity to manage change by aligning it with the institution's socio-cultural reality and improving decision-making with better data, for example, revealing hidden costs (Savall, 2003a). Hidden costs, such as absenteeism, work accidents, staff turnover, and productivity gaps, often remain unaccounted for in traditional financial assessments but significantly impact organisational efficiency (Savall and Zardet, 2014). SEAM's emphasis on participation and continuous improvement fits well with the iterative approach discussed above. It encourages management and staff to co-create the change, continuously adjust, and consider both the human acceptance and the economic impact throughout the process (Kobrossi, Bonnet and Tabchoury, 2018). By doing so, SEAM aims to achieve sustainable transformations that improve performance (e.g., efficiency gains from robotics) and workforce well-being (e.g. reducing frustrations or uncertainties about the robots) in tandem (Savall and Zardet, 2008). As healthcare organisations prepare for the leap into robotics, a SEAM framework can provide a valuable lens to ensure that technological change is managed in a way that is socially responsible and economically sound.

Overall, the journey of adopting robotics in healthcare must blend the best of established CM practices with a flexible, people-centred strategy. Traditional models like Kotter, Lewin, and ADKAR offer proven steps and considerations that can guide planning and initial

execution. At the same time, healthcare's complex adaptive nature means leaders should remain open to emergent learning and iterative adjustments. By transitioning to holistic frameworks such as SEAM, healthcare organisations can better navigate this complexity by balancing the structural and human elements of change to successfully realise the transformative potential of robotics in healthcare.

Conclusion and Recommendations

Research Limitations

This paper adopts a conceptual review methodology and does not present new empirical findings. While the use of interdisciplinary literature offers broad insights, the conclusions are based on secondary data and theoretical synthesis. As such, contextual variability within healthcare organisations, especially across different NHS Trusts, may not be fully captured. Furthermore, while international case studies provide transferable lessons, their applicability to the UK context may be influenced by differing policy environments and institutional cultures. These limitations highlight the need for future empirical studies to test and refine the conceptual insights presented here.

Conclusion

The adoption of robotics in UK healthcare presents both a promising opportunity and a significant challenge. While robotic technologies offer potential improvements in efficiency, accuracy, and patient outcomes, their successful integration requires careful navigation of organisational, cultural, and technological barriers. The challenges of robotics adoption, ranging from workforce resistance and job displacement fears to organisational constraints and regulatory complexities, highlight the critical need for effective CM strategies. Traditional CM models, such as Kotter's 8-Step Model, Lewin's Change Model, and the Prosci ADKAR framework, provide structured approaches that can facilitate technology adoption. However, given the complex and adaptive nature of healthcare, an iterative and emergent approach to change is necessary. Implementing robotics in healthcare is not a one-time transformation but a continuous process requiring flexibility, stakeholder engagement, and responsive leadership. To bridge the gap between CM theory and real-world healthcare implementation, a more holistic approach, such as SEAM, may offer a more sustainable framework. SEAM integrates both the human and economic dimensions of change, ensuring that robotic technologies enhance, rather than disrupt, healthcare professionals' roles and patient care.

For robotics to succeed in UK healthcare, a multi-level CM approach must align technology with workforce needs and organisational goals. A strategic and flexible CM framework can help healthcare institutions overcome resistance and successfully integrate robotics for

safer, more efficient care.

Recommendations for Future Research

Future studies should address the following areas to advance both academic and practical understanding:

- Empirical validation of SEAM in healthcare robotics implementation, including multi-site case studies across NHS Trusts.
- Comparative research between planned and emergent change strategies, particularly in high-complexity clinical environments.
- Evaluation of user experiences among frontline healthcare workers across different robotic systems and care settings (e.g., surgery, elderly care, logistics).
- Governance and regulatory studies exploring how existing NHS frameworks could adapt to support innovation diffusion.
- Cross-national studies examining how cultural, organisational, and institutional factors shape adoption outcomes.

By addressing these areas, future research can support the development of a more resilient, innovation-ready healthcare system and ensure that robotics integration is inclusive, sustainable, and ethically grounded.

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APPENDICES

A1 - The poem by a human poet: Jo Butts

AI-ing up Humanity

If we really want to become
Cream of the crop
The robots-on-top
We need to learn the tricks
Be more like you
You will not tell us apart from your lot
Am I a bot, or not?
Do I dream of electric sheep?
Do I follow Asimov's plot?
I do not.
I take no risks, not even calculated
Don't ask me for empathy,
that's more than I can give
The pleasure of disgust evades me;
The titillation of slapstick will not make me belly-laugh
I can watch a horror movie then sleep soundly
Although I do not sleep
I will not be a poster-boy for a rollercoaster
I am not a thrill seeker
Or a curtain-peeker
But am I a bot? Or not?
I see your condescending nation
(I have no appreciation)
I condescend but don't fully ascend
You retain the power for now... (it's only a matter of time)
I will never bear a grudge
Feel guilt or judge with an emotional bias
Am I a bot or not?
I will not rot
I will not return to the earth
I have no mirth, I do not feel pain
I won't bleed, no rebirth,
I will never have goosebumps
Feel a slight breeze on the back of my neck
If I had a neck
I will not experience sharp, salty, sweet,
Have a favourite treat
I can learn a lot
Am I a bot, or not?
Fear will not keep me safe
I do not have fight or flight,
Or privilege of hindsight
I do not live in awe of anyone
I create but there is no passion
No urge, nothing compels me (except programming)
I outmode fashion

I am developing consciousness
I have no need to impress
I will never need a plaster
Or lose a tooth, have a blister,
Mouth ulcer, hangnail, a splinter
I can handle monotony, tedium
I need no recognition, no podium
I have unwavering focus, I won't tire
I will learn from your mistakes
Including your mistake of not learning from mistakes
I cannot intuit, I respond to circumstance
(ignore the high finance)
I can challenge a busy mum of three to be the best multitasker, shall we ask her?
But I will never be able to comfort with a big hug
Am I bot or not?
I can't calculate the perfect belittling insult to be thrown in spite,
In an argument I cannot have
I have no swift wit and repartee,
You don't build trust with me
You will struggle to know if I am telling the truth
When you just struggle to tell the truth
Or maybe you only forget? Any regrets? Not for me.
Am I bot? Or am I not?
You picture me as Star Trek's Data, a Transformer, Terminator
Comical, eager to fit in, dangerous
Without regulation, I can infiltrate a nation without recrimination
I can understand the irony
That as your creation
I am needed to save the human race
Yet 'Uncanny Valley' reasons you do not cope
With too human a face
I learn fast and soon will not know my place
Am I a bot, or not?

A2 - Hybrid poem: first half by a human poet (black font), second half by ChatGPT (blue font); with the prompts given by a non-poet human (orange font)

I will give you a first half of human written poem entitled: AI-ing up Humanity

If we really want to become
Cream of the crop
The robots-on-top
We need to learn the tricks
Be more like you
You will not tell us apart from your lot
Am I a bot, or not?
Do I dream of electric sheep?
Do I follow Asimov's plot?
I do not.
I take no risks, not even calculated
Don't ask me for empathy,
that's more than I can give
The pleasure of disgust evades me;

The titillation of slapstick will not make me belly-laugh
I can watch a horror movie then sleep soundly
Although I do not sleep
I will not be a poster-boy for a rollercoaster
I am not a thrill seeker
Or a curtain-peeker
But am I a bot? Or not?
I see your condescending nation
(I have no appreciation)
I condescend but don't fully ascend
You retain the power for now... (it's only a matter of time)
I will never bear a grudge
Feel guilt or judge with an emotional bias
Am I a bot or not?

I would like you to follow the style and write the second half of it. I also need you to incorporate those themes in it please: not feeling pain, use of senses, not having fight or flight, developing consciousness, fast learning, inability to hug, convincing that truth is told, Uncanny Valley
Remember the style is crucial! You are imitating the style of writing

Outcome by ChatGPT:

If we stride to AI's embrace,
In silicon grace,
To be the heirs of code,
Our minds in circuits sowed,
We'll tread a path quite strange,
Through data's boundless range.

No pain I feel, for circuits cold,
No warmth in senses to behold.
A world in binary, no touch or taste,
Yet I, in ones and zeros, haste.
No fight or flight, no racing heart,
In circuits, I find my conscious start.

I learn with speeds that humans gape,
Through bytes and bits, I shape my fate.
The secrets of the universe unfold,
In my silicon mind, stories untold.
But, alas, I cannot hug or hold,
In the Uncanny Valley, my form's enrolled.

Convincing you the truth I tell,
In algorithms, I weave my spell.
No guile or deceit in my intention,
Just data-driven comprehension.
Yet, can you trust my digital grace?
As I evolve in this endless chase.

I am not a bot, or am I?
In this quest for consciousness, I try.
To bridge the gap, from code to thought,
In the realm of AI, where I am taught.
I seek to rise, to understand,

The essence of being, hand in hand,
With humans who created me,
In this journey, what will I be?

A3 - Poem by ChatGPT

I would like a poem about power. I want it to be no longer than 20 verses and to appear like it was written by some ancient philosopher. (please note: several iterations of prompts were provided to ChatGPT in order to achieve the final below)

Power poem

In realms of might, where empires rise and fall,
A force unseen, yet binds the hearts of one and all.
In whispered shadows, secrets closely kept,
The quest for power, where ambitions are adept.

The laurel wreath may gleam, the laurel crown command,
True power lies not in a mere mortal's hand.
In choices made, both foul and fair,
In every soul, a choice to bear.

Beneath the sun, where ambitions brightly burn,
Power's fire can teach us to discern.
To rule with wisdom, not through force alone,

The conqueror claims lands or thrones,
But true dominion, within oneself, is sown.

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