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Towards a Conceptual Framework of AI-Enabled Digital Portfolio-Based Curriculum and Assessment Design

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Abstract

This article conceptualizes the use of digital portfolios in higher education and the opportunities and challenges these bring in the era of GenAI (Generative Artificial Intelligence). It proposes the 4P framework: Purpose, Product, Process, and People, to enhance portfolio-based learning and assessment as learning through the integration of AI. The framework offers key pedagogic design considerations for meaningful engagement with portfolios that support reflective, digital, and critical skills development in creative and connected ways across disciplines, professional areas, and academic levels. Digital portfolios are positioned as increasingly relevant tools for defining, developing, and facilitating student-led learning that is purposeful, stimulating, and enriching, while responding to the opportunities and risks presented by AI. The 4Ps framework supports educators in designing flexible, inclusive, and authentic learning experiences that extend beyond the curriculum, and into lifelong and life-wide learning. It provides a conceptual foundation for integrating AI into portfolios in ways that promote agency and action, helping students feel connected to others and the world. Portfolios can serve as a bridge between reflection and action, with AI streamlining documentation processes to allow more time for deeper thinking. AI-enabled portfolios also offer opportunities to collectivize learning through the creation of public, shareable resources that contribute to wider societal conversations. The paper argues that AI is inescapably important in the development of frameworks for digital portfolios that are authentic in assessment and support regenerative approaches to learning and teaching. The 4Ps framework offers a practical and conceptual tool for navigating the evolving curriculum and assessment landscape in higher education.

Keywords: Digital portfolios, e-portfolios, assessment, learning design, conceptual framework, AI-enabled

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Introduction

The ever-increasing demands on educators to enhance curricula with inclusive, authentic, co-constructed, extra-curricular, lifelong and life-wide learning experiences can present complex challenges for assessors, assessment and module structures. The University of Leeds is a research-intensive Russell Group institution with around 40,000 students and 10,000 staff. Digital, professional as well as academic skills form three interdependent cornerstones of the University's student skills for assessment. The university, since 2023-2024, has been rationalizing modules and programmes as part of 'Curriculum Redefined', an institution-wide project to transform student education across all taught provision.

We believe students should have the opportunity to initiate learning in diverse ways to pursue their own personal and professional interests as these will enrich their learning journey. Enabling and nurturing such activities within and beyond modules will offer a situated learning ethos that respond to students' immediate matters of concern, interests and aspirations as well as location and everyday lives. Such learning opportunities can be seen as ecological, to awaken, keep alive and further strengthen the love for life-wide learning (EU Commission, 2000; Jackson, 2011; Redecker et al., 2011; Centenary Commission on Adult Education, 2019) and lifelong learning, and commitment for participatory action to benefit life on our planet.

Context

The proposed digital or e-portfolio framework is values-driven and recognizes our interconnectedness with the world for renewal, the need for synergies and collaboration as well

as autonomy to sustain and transform (Jackson & Barnett, 2019). Supporting our students to develop capabilities to become and be active members of society and feel able, responsible, and empowered to make positive contributions throughout life and help shape the present and future of life on Earth are vital (OECD, 2019; UNESCO, 2023a; Ehlers et al., 2024). This future is already being shaped and impacted by AI, and the emotions this trigger amongst educators and learners (Dixon, 2024, p.14).

In presenting our proposal for digital portfolio designs, we acknowledge the emergent nature of design prototyping, where novel ideas develop from creative collaging, building new syntheses from existing ideas and practices (see Harris, 1998; Kessels, 2016; Nerantzi, 2022). This approach applies to curriculum design interventions and approaches that are re-appropriated in new contexts. We propose the repurposing and adapting of existing pedagogical approaches and practices to design curricula that are sustainable over time. A secondary aim is to model the value of re-using existing Open Educational Resources (OER) and Open Educational Practices (OEP) as well as demonstrating the value of authentic, collaborative, co-designed, evidence-based, and evidence-informed approaches to curriculum design through the application of digital portfolios.

Portfolios are a recognized feature for the development, recording and evaluation of skills and competencies across a range of subjects, such as visual arts (Paulson et al., 1991), medical subjects (Driessen, et al., 2007), communication subjects such as English and Journalism, as well as in business and education training (Zubizarreta, 2009). Their development as digital tools for education and development can aid a shift towards assessment of a learner's progress and

developing potential, rather than simply a measurement of an outcome (Abrami & Barrett, 2005; Lu, 2021; Renwick, 2021; Mogas et al., 2023), therefore align with the concept assessment as learning (Yan & Yang, 2022).

Although, for more traditional visual arts perspectives, this can represent a conflation of portfolios as workbooks and portfolios of artefacts. In an inclusive sense, portfolios are useful for capturing a sense of development over time and provide a useful resource for learners to return to, to consider their next steps rather than simply acquire a number or grade as an evaluative demonstration of potential (Renwick, 2021). This is because digital portfolios can be used as a tool for the recording of development, achievements and reflective understanding across the whole learning journey (Quinn, 2024). Digital portfolios offer a more inclusive, and authentic mode of assessment (Renwick, 2021; Quinn, 2024) that can alter the assessment practices and behaviours of both educators and learners.

Authenticity increasingly means that at some point, digital portfolios must react to the opportunities and challenges being presented by AI, as it becomes a normative feature of the skills transformation the world of work is undergoing (Dixon, 2024). Digital portfolios should not only be about academic instruction but also about building resilience through real-world learning (Fisher & Wheeler, 2025), presumably also providing resources for navigating the shocks of rapid technological and social change being wrought by AI.

Before university, "About 80% of thirteen- to seventeen-year-old UK students are already using AI tools such as ChatGPT on a regular basis" (Dixon, 2024, p. 83). Not to include AI in university work, given the current pace of integration into the worlds of work and study, is to risk assessment being "literally unplugged from reality" (Dixon, 2024, p. 83). AI alone will not solve the challenges of future proofing students for lifelong learning but neither will leave it alone in learning contexts. The critical skills required for digital portfolios are broadly the same as for AI-enabled learning, which requires agile digital skills, creativity, and critical thinking to develop a common sense and evaluate claims to truth (Dixon, 2024). Yet AI will continue to fuel concerns about present challenges to the digital transformation of university education.

Renwick (2021) argues that digital portfolios can be a dynamic tool that enables learners to edit and perform through multimedia documentation, an understanding of their readiness for future challenges and their personal development or employment goals. This involves both educators and learners moving away from the idea of solely focusing on assessment as some test to be passed, that can be effectively represented as a measurement or grade. Chiang et al. (2024) argue that generative AI (GenAI), such as ChatGPT, can help develop a more balanced approach to assessment of learning as process and outcome/s. Any shift from numerical evaluation to a focus on the creative and reflective construction of evidence of strengths, supported by a learner's critical reflection, is better at capturing learning as development over time (Renwick, 2021).

It is suggested that the integration of AI can be used to offer more personalised and versatile feedback (Khasawneh et al., 2025). Creativity is increasingly seen as a core future employability

skill, (World Economic Forum, 2025), and digital portfolios offer new authentic opportunities for learners to perform the curation, display, and reflection on their own learning (Renwick, 2021; Quinn, 2024). This entails the integration of digital audio-visual material that is advantageous to inclusivity and accessibility as well as developing authentic skills necessary for work and life. Digital portfolios are recognized for their potential to develop autonomous and digital competencies (Mogas et al., 2023). There is an increasing area of development with custom AI agents which are offering students the opportunity to practice real world skills via scenario or role-based spaces. An example of this is the partnership between Monash University in Australia and Warwick University in the UK. They have developed a number of these AI agents for student practice (Digital Education Network meeting, University of Leeds, 20 August 2025 – presentation from Monash and Warwick Universities). The inclusion of AI into digital portfolios further enhances the possibilities for learners to develop multiliteracies (Ni & Lam, 2025, p. 1).

Objectives

We propose the use of AI integrated digital portfolios in higher education to create a rich learning space to help and support students navigate the module and scaffold their learning experience. The 4P approach for digital portfolios (purpose, process, product, and people) by Nerantzi (2024) is proposed as a means of promoting learning through assessment. Students would be able to use these AI and other digital resources in combination with other digital portfolio platforms of their choice. While there are many benefits of using digital portfolios within individual modules, they appear to work better across a whole programme of study (Busch & Gilbertson, 2024) and

beyond, using life wide and lifelong engagement approaches, and this is something to be mindful of.

Methodology

This paper is a reflective thought piece. It demonstrates a pragmatic and speculative approach to integrating AI with scholarship. This process is based on reflective practice to gain deep and critical insights to deal with complex challenges, dilemmas, and opportunities to construct new conceptual meaning that leads to change (Schön, 1983). Co-authors of this paper worked together to inquire into the feasibility of a conceptual framework for digital portfolios in higher education learning, teaching, curriculum, and assessment design.

Towards a conceptual framework for digital portfolio-based assessment as learning

The focus of the inquiry in this paper is a critical exploration to free digital portfolios from clutter and identify essential features of what will bring clarity and focus to users (Kleiman, 2009), whilst considering what affordances may exist to enable adaptable integration of AI into the framework and digital portfolio-based learning.

Assessment capabilities, often referred to as 'future skills' needed to help individuals to become adaptable and thrive in an ever-changing and uncertain world (Kotsiou et al. 2022) are themselves rapidly changing in response to the impacts of AI. The Kotsiou et al.'s (2022) analysis of 99 frameworks for future skills identified 'nine main meta-categories, which are: higher-order

thinking skills, dialogue skills, digital and STEM (Science, Technology, Engineering, and Maths) literacy, values, self-management, lifelong learning, enterprise skills, flexibility, and leadership' (Kotsiou et al., 2022). These capabilities do not explicitly relate to portfolios; so, we decided to develop the four dimensions of the conceptual framework for portfolio-based assessment as learning and curriculum design, which are presented below.

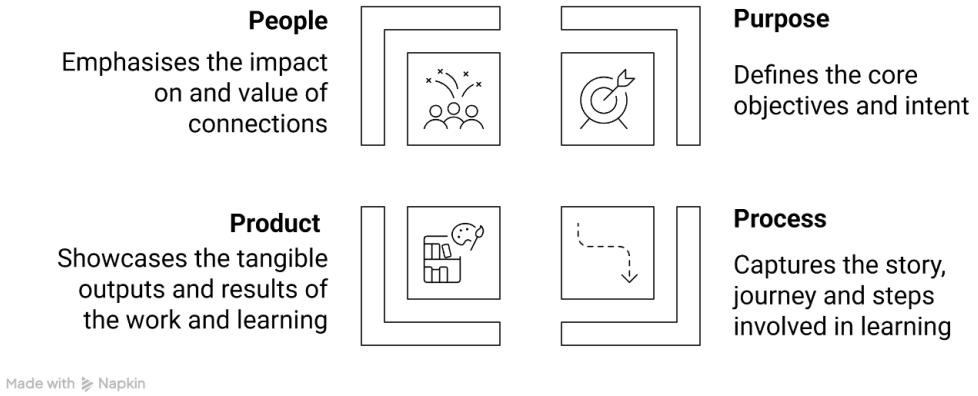
Mohamat et al. (2016) explored designs for digital portfolios in higher education contexts (2016) with three distinct functions: storage, workspace, and showcase. These functions are adapted and reframed as the 4P portfolio dimensions (Nerantzi, 2024) that borrow elements from Mohamat et al. (2016) to expand with an added emphasis on the dimensions of purpose and people. Storage informs the purpose of digital portfolios as a place for collecting materials for the narrative and documentation of the learning process and outcomes. Workspace is where the process of narrativisation, documentation, and reflection takes place. Showcase informs the emphasis also on the portfolio as a finished outward facing product, that displays outputs and artefacts. People is an additional dimension. These 4Ps are discussed below.

Dimensions towards the 4P conceptual framework for digital portfolio-based curriculum and assessment design (Figure 1.)

- Purpose – what it is for?
- Process – the story of the activity
- Product – outputs and artefacts
- People – the value to wider groups, users or the public

Figure 1

4P conceptual framework for digital portfolio-based curriculum and assessment design



Purpose

The purpose dimension of portfolios defines what the portfolio will be for. Portfolios can serve a range of purposes such as for personal, professional learning, and development, personal tutoring, revision, employability, professional recognition and accreditation, assessment and lifelong and life-wide learning, as well as role- and scenario-based learning (Mohamat et al., 2016; Busch & Gilbertson, 2024). Lifelong learning is defined "as learning that continues throughout life to address an individual's learning needs" (UNESCO, 2006, p. 420), while life-wide learning means simultaneously engaging in a range of formal, informal, and non-formal learning experiences that stretch across domains and include personal interests and hobbies as well as well-being activities (Jackson, 2011). Such transdisciplinary learning is not just for their engagement and success at university but also to help them take responsibility for their learning and to develop capabilities to act and positively contribute to society and their life on this planet.

It is important to engage with this dimension in a focused and systematic way to explore critically and creatively the opportunities a portfolio will bring for students studying on a higher education programme. Students are often asked to complete an assessment without (fully) articulating how it will help them learn and what they will be learning. Students ask what the point is. The lack of clarity and confusion can create challenges for students and educators.

It is important to explain the purpose of the learning and assessment approach to students as clearly as possible from the outset along with the specific requirements of a digital portfolio to enable students to engage in a meaningful way. Engaging students with defining the purpose of the learning may illustrate the value of flexible, personalized opportunities for inclusive engagement, and boost motivation and learning.

The working assumption is that when students understand the value of what they are asked to do and it makes sense to them, they will engage in a meaningful way without educators needing to monitor them and their work. The power of intrinsic motivation for learning and development is known (Deci & Ryan, 2011) and connected with the potential for boosting curiosity, imagination, criticality, and creativity in students so that they take more responsibility for their learning to harness the opportunities for continued growth and development that the university and life offer.

The integration of AI into digital portfolios presents opportunities and challenges. The number of jobs predicted to be changed over the coming decade means that AI is increasingly becoming

integral to learning in the education of many professions, and is already having an impact on student employability, and success securing industry placements (Neves et al., 2024; World Economic Forum, 2025). It is increasingly difficult to conceive digital literacies without AI competencies being a pillar of such educational experiences (Ehlers, 2024; UNESCO, 2024b, 2024c). With AI predicted to continue transforming employment at an accelerating rate over the next thirty years at least (Dixon, 2024), the opportunities seem imperative.

AI is already impacting learners in multiple contexts beyond education however (Jisc, 2025), and this emphasizes the challenge of preparing learners to consider the impact of AI on well-being, and even the social and ecological crises which are increasingly being foregrounded as central to a renewed purpose of education (OECD, 2019; Ehlers & Eigbrecht, 2024). The Purpose of digital portfolios is transformed by AI as it demands critical introduction to issues of AI's biases, ethical considerations and impact on democracy, environment, well-being of users, particularly in the social media sphere, and perceptions of truth.

Process

The process dimension of portfolios illuminates the importance of the journey, story, and activities that have led to specific products or outputs. It creates an opportunity for a reflective pause to slow down and notice. In a way, it is a workspace where we can track and document activities we have done. They are spaces for experimentation and reflection on experiences providing opportunity for self-evaluation. Notice the things that work, the things that do not. They enable learners to make sense of the things learnt from failing. While we recognize the

complexity of learning and how it can bring us discomfort, failing is not an easy word to use and we often avoid it in the context of assessment (Jancovich & Stevenson, 2021).

Portfolios can encourage self-reflection (Buckley et al., 2010, p. 187), which is pivotal to the integration of practical skills and theory (Hall, 1992, p. 81). This reflection can enable students to consider not just what has been learned but why (Zubizarreta, 2009, p. 5) revealing the extent to which a learner's values and goals or the expectations of others have shaped development. We can learn unexpected things from processes that shape our experiences. We learn through experience, even the experience of sitting in a lecture (Seaman, 2008). In this perspective, all learning is experiential. Thus, critical self-reflection is key to learning from experience. Brantmeier (2013, p. 4) notes, "Critical self-reflection is when one questions the assumptions of one's views, values, and behaviour; it is contemplative practice of examining the origination of one's worldview and gently, kindly, scrutinizing that worldview with comparative and contrasting frames of reference". Questioning in reflection can help learners make sense of good, bad, messy, and complex experiences, enabling people to move forward (Schön, 1983).

Reflection is about slowing down and noticing (Nasrallah, 2020), helping learning and growth, enabling people to develop and change the world around them. This responsibility is the key point of reflection, as it can create agency, action, and lead to transformation. Therefore, establishing reflective habits and capabilities is important for aa sense of agency and hope in) life (Ehlers, 2020). Using a wide range of approaches is key to ensuring reflective practice as accessible as possible. This variety is valuable as a plurality of reflective methods that draw on a

range of thoughts, perspectives, and activities including visualisation. It enables the broader expression and communication of ideas, demonstrating the creative dimension of reflection (Chan & Lee, 2021; Guillaumier, 2016; Samuels & Betts, 2007). Limiting reflection to the medium of writing can create challenges and many reflective models seem to create difficulties that lead some students to switch off (Chan & Lee, 2021). Lived experience rarely seems to align with neat models, a disconnect that students can find off-putting. Reflection is messy and not linear. A loose scaffold can, however, be helpful, although this need not necessarily be linear or cyclical. It should acknowledge the interconnectedness of reflection with the world (James & Brookfield, 2014; Nerantzi, 2024).

Curiosity and imagination are valuable ingredients in reflection, together with criticality, creativity, and playfulness (James & Brookfield, 2014). However, students can also experience fatigue where the purpose of reflection is not always clear, finding it too time consuming, too much work or stressful (Chan & Lee, 2021). Reflection can be emotionally and conceptually challenging for students and educators alike. The confessional nature of reflection may make people feel vulnerable and exposed when being asked to share insights, and this can be further complicated by cultural differences which need to be taken into consideration (Brantmeier, 2013). The authenticity of reflections, especially when writing for an audience, also remains uncertain. It is necessary to be mindful of these difficulties when assessing reflection. Nobody wants to render reflection a useless tool through crude application and over-use.

While reflection is fundamental to lifelong learning (Ehlers, 2020; Guillaumier, 2016), the priority is to ensure that engagement with reflection is authentic and meaningful. Modelling reflection can make a difference (Samuels & Betts, 2007) as well as engaging in reflection in a supportive way and engaging in feedback (Chan & Lee, 2021). It is important to remember that reflection directly links to learning by doing, making, playing, experimenting, listening, listening, conversation, even dancing for example (Csikszentmihalyi & Rochber-Halton, 1981). These activities need to be celebrated and combined in harmony with reflection (Dobson & Walmsley, 2021). Learning is an experience of the head, heart, and hand (Bloom et al., 1964; Sipos et al., 2008). However, in higher education, sometimes, educators overly focus on the head, and the cognitive side of learning.

Documenting the learning process is no less being transformed by the advances in and increasing use of AI. Its importance may even increase and present an opportunity to move away from assessment as a product. Augmented photography (Adobe Photoshop), digital imaging (Napkin) and composition software (Canva) and numerous other apps all democratize the design and professionalization of presentations beyond those skill sets traditionally the preserve of specialist students. Sankey (2025) argues AI creates new opportunities for developing student digital portfolios; for example, documenting and representing the process of action and reflection. However, he argues that currently, AI is not yet proficient at joined up reflections but rather better at summarising.

In 2024-25, The University of Leeds (2025) adopted a three-tiered Red/Amber/Green (RAG) system to articulate how students can use Generative Artificial Intelligence (Gen AI, AI) tools in summative assessments. The three categories of red, amber, and green are not defined rigidly. They are intended as a tool so that staff and students have a shared understanding of how Gen AI tools can be used in a particular assessment, by how much and at what stage of the assessment process. Integrating AI into the documentation of the learning process for digital portfolios might seem like the easiest first step, as so much of existing digital technology is already AI augmented. It seems increasingly difficult to imagine how the use of AI can be banned in the process of developing digital portfolios and documenting learning due to the growing ubiquity of its integration into the web and apps. However, anxieties remain fueling the limitation of AI use to documenting the learning process, holding students back from using AI in generating outcomes and products in ways that may be increasingly common in their future fields of work.

Product

The product dimension of portfolios is probably the one most familiar to many. People's lives are often presented as a sequence of products or outputs. We love making, collecting, displaying, and showcasing things. Think about photo albums, collections of teapots and stamps, models and objects that we feel an attachment to. Individuals are also judged and measured based on their products, their creations, especially when it comes to course and job applications and promotions for example. Assessments often focus on products and things we have made. We are familiar with keeping track of and documenting our products. Portfolios can host our products, evidence,

and achievements in a module, programme of study, and activities across life to support employment processes, for example (Mohamad, et al., 2016).

People can be reluctant to acknowledge where ideas come from and often what they present as theirs is really an original re-creation or synthesis. This is not a new situation, but AI has perhaps amplified the blurred nature of creation, and notions of origin and originality. We are all products of our time. All work is collaborative, borrowed and is a recombination of other ideas. There is nothing new under the sun. This seems to be something many people are just discovering now because of AI. This may be because people cannot claim AI creations as entirely their own and students often cannot seek credit for them in the same way as traditionally produced work. Ownership of ideas is something humans feel strongly about, perhaps because of the competitive and antagonistic world we live in. This is something necessary to think about also when assessing not only student outputs or products but also what they are being asked to make and why.

It can be helpful to think of portfolios as a collection of products or as a cabinet of curiosities. In these, we showcase things we have made, things we have been asked to make in the context of a module or a programme for example, and things we must submit for assessment and the scrutiny of others. Portfolios can also hold things we love and things we feel attached to. Storing, curating, and organizing outputs in digital portfolios enables us to be imaginative and see our imagination in front of our eyes. Digital portfolios are versatile when it comes to showcasing the products of learning (Mohamat et al., 2016). Digital portfolios can be expansive, flexible, and

stretch and accommodate larger volumes of entries and formats. They are portable, mobile, and resilient to damage.

The anxieties that persist in some educational contexts around permitting students to use AI in generating products and outcomes of modules are connected to varying emotions provoked by concerns for AI's impact on practical skills and hands on practices, concerns about ethics, originality, authenticity, and ownership of ideas and cultural products. Anxiety is not just about the generation of outcomes but also about sharing of products.

It is not just students who are increasingly concerned; some academics have traditionally been anxious about sharing teaching material, but Dixon (2024) argues that AI emphasizes that the value of ideas will be in sharing them and building recognition and relationships for your participation in discourse and the social movement of ideas. These concerns are not new, but AI is supercharging wider critical awareness of these issues simultaneously highlighting that these issues may be complex problems, and thinking may be simplistic or rapidly seem dated. What is a challenge for both students and educators is working through the sometimes-difficult emotional hurdles that technological changes can present to traditions, practices, and prior beliefs. How each discipline responds to these challenges is likely to reflect how far it has already travelled along the journey of the digital transformation of education.

People

The people dimension of portfolios emphasizes the value of others in the context of learning. While portfolios can be personal spaces, containers that often remain hidden from public view (Nerantzi, 2024), the link to others and the social dimension of learning and going public with your learning is important. The people dimension includes recognition of some of the challenges of sharing work including the increased vulnerability experienced when sharing personal experiences and reflections on these (Brantmeier, 2013). However, there is value in creating accountable spaces (Ahenkorah, 2020) that are characterized by the principles of mutual respect and equity that facilitate opening-up, sharing of ideas, and connecting with others through engagement in wider conversations. It is through opening up to exchange and coming together and collaborating with people who think differently from us that creative, significant transformational learning can happen. Collaboration is paramount for creativity to flourish (Guillaumier, 2016; Nerantzi & Thomas, 2019). Spaces that facilitate collaboration and recognise communal engagement play an important role in the use of portfolios that further advance intellectual questioning, collective development, and learning (Sarmiento, 2004).

Reflection is often seen as a solo, or we could even say, an isolated experience. How useful is this? We are social beings. Learning is a social experience. Creating opportunities for sharing, dialogue, exchange and conversation about what moves us, what troubles us, and considering alternative perspectives can be enlightening, enriching, and surprising too at times (Samuels & Betts, 2007). Collaborative ways of learning may also help open minds to other perspectives, question and be

questioned, challenge and be challenged which in turn may lead to deeper and more critical engagement with one's own experiences and those of others.

Furthermore, students often feel lonely and can rely almost exclusively on their tutors for support and conversation, especially early on in their programmes. The findings of a study with a focus on studying the perceptions of learning among ethnically diverse students in four UK universities during the pandemic suggest that there has been an overreliance on tutors by students (Dunbar-Morris et al., 2023; Nerantzi et al., 2023). Can the same happen with digital portfolios? Often, the only person a portfolio is shared with may be the tutor. What are the implications? This sharing is one-directional, and while it can be conversational and dialogic in nature between the educator and the students, engagement is still often limited to these two individuals. Digital portfolios have the possibility to be more than one-directional so that students can share them with their tutors, peers, and others outside their course of study. Sharing their portfolios will give them opportunities to engage in wider conversations around their work, seek, and provide feedback that will also lead them to review their own work. Valuable insight into their own reflection can be gained through such engagement that also builds their confidence.

Digital portfolios can be useful in peer review which is an excellent vehicle for honest critique and the sharing of viewpoints. They offer opportunities to expand the learning community if we are not constrained by current practices which may over-emphasize the staff-student relationship at the expense of other learning relationships. We recognize the value of social learning and the opportunities portfolios present to trigger and sustain diverse learning conversations. This

expansion has the potential to open-up and connect thoughts, activities, reflections, and perspectives and really engage with what helps us learn the most, to question and be questioned.

There is often a misconception that personalized learning is expensive for universities. What we seem to forget is what social learning can create through establishing, fostering and nurturing peer-to-peer learning communities as well as wider open learning communities and networks (Ehlers, 2020). The creation of such learning communities has the potential to further expand not only our students' horizons but also a better model of what is happening in what we call 'the real world' beyond academia. Connecting with others and collaborating with diverse others are important aspects of everyday life that can be cultivated while at university. Digital portfolio-based learning can offer a gateway to such opportunities to help our students feel connected with the world outside their course. Such an approach has the potential to build valuable praxis, competencies, and confidence.

Perhaps, the biggest challenge for integrating AI into the 4P framework for digital portfolios would seem to be the people dimension. Digital portfolios may create a sense of impersonal detachment from module tutors, especially on modules where contact time is low or student numbers large. Where AI may, paradoxically help, is in challenging sometimes closed or occasionally overdependent learning relationships with tutors. It is predicted that the increasing prevalence of AI in work and study will place a premium on human interaction (Dixon, 2024). Nevertheless, AI will need to be thought of as one collaborator amongst many, and a tool for teaching reflection on collaboration. Learners need to see AI much like tutors in later stages of

learning as facilitators of their own autonomy and responsibility for learning. AI chat bots can be used to facilitate dialogue, to open up perspectives beyond those of the tutor, even expanding EDI and decolonial perspectives where relevant. In framing AI as a collaborator, the student learns to acknowledge the contributions of others, but also the need to critically evaluate and check the perspectives of others and their own. Ideally, AI-enabled digital portfolios should be able to encourage their visibility, encouraging students to make their learning experiences and journeys visible, which are an integral part of building the networks and communities of practice necessary for lifelong and life wide learning.

D'Souza et al. (2025), however, emphasise that doing so places extra demands on the human and interpersonal resources of expertise, digital competencies, and dialogue needed to build the relationships of trust necessary for meaningful and productive integration of AI. Such work is no small task, and the D'Souza et al. (2025) argue it requires a 'relationship ecosystem' for the collaborative co-construction of adaptable and flexible digital portfolio structures that values the inputs of modular and programme academic, learning designers, students, and AI. This can help build the kind of resilience for the choices that come with rapid technological and social change that many are currently experiencing (Fisher, 2025). This may only be possible, however, if all involved can manage the vulnerability, remain mindful, and manage the stresses that come with navigating the opportunities and challenges of integrating AI (Khasawneh et al. 2025) into the complex learning vehicles and experiences of digital portfolios.

Towards action-oriented education

The rationale for designing digital portfolio-based learning and assessment is grounded, above all, in an appreciation of the urgency and complexity of societal and global challenges that we currently face, and the need as educators to support a transition towards more active engagement in meeting these challenges. We acknowledge both the appetite for and urgent need to move towards more action-oriented education that is empowering students to make positive contributions to societal challenges.

The gravity of these challenges has far-reaching implications for universities and prompts us to critically re-evaluate the purpose of universities and re-examine our relationship with the communities.

On the one hand, universities are places of respite and a refuge to test new ideas, for lateral thinking and for creating new knowledge that still lies outside of mainstream awareness. On the other hand, knowledge production can benefit from a dialogue with society, actively involving citizens and non-academic partners such as business, non-governmental organizations, public authorities, and others that share objectives with the university. Both areas will remain fundamental for the universities' service to society (EUA, 2021).

UNESCO is clear that universities play a key role in becoming spaces for lifelong and life wide learning (UNESCO, 2023a). Indeed, universities create spaces that have the potential to unleash transformative power in our students and enable them to take a pro-active, responsible, and

confident role in shaping the society. A crucial element here is the need to move towards action (Ehlers et al., 2024).

This point was echoed in a recent forum of young people discussing climate education; there is a real appetite for action and young people are clear that they want more agency and empowerment from their education (Bishop, 2023). Similarly, when asked to consider what changes they would like to see in the UK and globally within the next 10 years, young people focused on "tackling urgent, near-term societal challenges" (British Science Association, 2022, p. 7). There is a practical and pedagogic consensus building that shortens the link between education and societal action. As educators and learning designers, the challenge then emerges. How do we reframe learning and activities we design to meet these ambitions? Both the means of capturing learning and the process of engaging students in reflection on their own learning seem central to meeting this challenge.

Reflective practice and indeed critical and creative reflective praxis play a key role in turning learning into action (Freire, 2011) awakening curiosity and imagination as drivers to action. Digital portfolios can be an effective way to help higher education students to develop and grow into active people within a module, integrate their programme of study and life, and lay the foundations to contribute positively to the society.

We believe digital portfolios can provide a plethora of opportunities during the learning process for students across disciplines and professional areas to develop critical and creative reflection

and recognize their value for learning, not just during their formal education, but also recognize what an essential life skill reflection can be. Indeed, engaging students with reflection during their studies can help them become reflective citizens for ongoing growth and renewal (Ehlers, 2020). It is also important to note that this is a unique opportunity for students to start developing skills as they develop creative and critical portfolios, such as digital literacy and other employment and life-related skills which are being surfaced, such as confidence, self-awareness, responsibility, asking for feedback etc.

The four dimensions of digital portfolios introduced here, purpose, process, product, and people, are design elements when considering the application of digital portfolios in the curriculum and when designing assessment strategies. We hypothesize that this delineation and analysis of these component parts when designing learning and assessment approaches will support the creation of flexible and highly personalized pathways for students to enable this action-orientated capacity to flourish.

Higher education should position students as life-wide and lifelong learners. It ought to provide a supportive bridge, a safe space to move towards action. Digital portfolios and their self-directed, outwards focused, holistic approach to learning aim to develop autonomy, agency and empower students to take ownership of their learning and life (Ayyappan, 2024). Portfolios present an opportunity to bridge the chasm between university life and what we often call ‘the outside world’ or ‘real life’.

AI's capabilities will continue improving in relation to human abilities (OECD, 2025). Educators and students will have to learn how to navigate the new ecosystem and collaborate responsibly and ethically with AI in this entangled world (Matson, 2025). There are challenges and AI is fuelling some of the societal, economic and environmental issues, inequalities and exclusion. Big tech corporations seem to drive the innovation race in education (UNESCO, 2023b). There are alternatives. The UNESCO (2024a) Dubai Declaration on Open Educational Resources, which supports the implementation of the UNESCO (2022) 2019 Recommendation on OER, illuminates the opportunities AI can bring to education for equitable education for all through openness. This includes boundary-crossing collaboration and diverse connections in a culturally rich ecosystem that is value driven and grows on cross-fertilisation of ideas to boost collective human agency in an AI world. The four Ps framework for AI-enabled digital portfolios offers a conceptual resource for nurturing that ecosystem.

We propose the framework can support the relationships that connect purposeful yet critical employability skills, balancing the demanding processes of documentation and reflection, whilst freeing learners from origin myths of originality that can distance individuals from participating in communities of practice that celebrate the contributions of other people. In turn, we hope that the framework supports the purpose of universities in this world as regenerative spaces for lifelong and life wide learning for all is significant and should be considered. Therefore, creating spaces for responsible experimentation with AI and learning how to use and create AI will be important so that universities do not risk becoming a casualty of it (Dixon, 2024) and decide the direction and speed of change instead of these being imposed on them.

Conclusions

This paper proposes the 4Ps framework to integrate AI into digital portfolios to support educators seeking to enhance curricula with co-constructed, extra-curricular, lifelong, life wide, inclusive, and authentic, learning experiences and explore assessment as learning across disciplines and professional areas at undergraduate or postgraduate level. While it has been conceptualised as a curriculum and assessment design tool, it could also be considered in cases where digital portfolios are used to develop assessment rubrics and/or evaluate the effectiveness of portfolio-based learning.

The paper argues that it is important to productively respond to the challenges of integrating AI into flexible curriculum, module, and assessment design whilst remaining attentive to the challenges and risks that AI represents for the ongoing digital transformation of learning. One major driver of this inquiry into digital portfolios has been the goal of helping our students develop agency and the capacity to act, to contribute not just economically but also to feel connected to other people and the world. The conceptual framework and its four dimensions, purpose, process, people, and product, provides a useful way to approach digital portfolio design for learning and assessment. Digital portfolios can be that bridge between reflection and action. In particular, AI can streamline processes of digitally documenting process, to make time for deeper reflection and critical thinking. AI-enabled digital portfolios also offer multiple opportunities to collectivize learning, in the production of public, easily shared resources that can make a wider societal contribution. We speculate that AI is inescapably important in the development of frameworks for digital portfolios for them to be authentic in assessment and

support lifelong and life wide approaches to learning that are needed to regenerate the purpose, processes, products, and people of higher education.

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References

Abrami, P. C., & Barrett, H. (2005). Directions for research and development on electronic portfolios. *Canadian Journal of Learning and Technology*. *31*(3), Fall 2005. ERIC - EJ1073740 - Directions for Research and Development on Electronic Portfolios, Canadian Journal of Learning and Technology, 2005 (ed.gov). https://eric.ed.gov/?id=EJ1073740.

Ahenkorah, E. (2020). Safe and brave spaces don't work (and what you can do instead), 21 Sep 2020. https://medium.com/@elise.k.ahen/safe-and-brave-spaces-dont-work-and-what-you-can-do-instead-f265aa339aff.

Ayyappan, A. (2024). Lifelong learning in the age of AI. Only connect. A blog from the UNESCO Institute for Lifelong learning. 19 March 2024. https://thelifelonglearningblog.uil.unesco.org/2024/03/19/lifelong-learning-in-the-age-of-ai/.

Bishop, C. (2023). *Future Forum: Climate change in secondary schools: young people's views of climate change and sustainability education*. British Science Association. https://www.britishscienceassociation.org/Handlers/Download.ashx?IDMF=68f84964-bf1e-4bfb-8205-444705d9678a .

Bloom, B. S., Masia, B. B., & Krathwohl, D. R. (1964). *Taxonomy of Educational Objectives* (Two Volumes: The Affective Domain and The Cognitive Domain). David McKay and Co.

Brantmeier, E. J. (2013). Pedagogy of vulnerability: Definitions, assumptions, and applications. In: Lin, J., Oxford, R., Brantmeier, E.J. *Re-Envisioning Higher Education: Embodied Pathways to Wisdom and Transformation*. Information Age Publishing.

British Science Association. (2022). *Future Forum: Creativity in STEM: Young people's views on using collective collaboration to build a better future*. British Science Association in collaboration with Unboxed Creativity in the UK. https://www.britishscienceassociation.org/News/future-forum-report-2022-published.

Buckley, S., Coleman, J., & Khan, K. (2010). Best evidence on the educational effects of undergraduate portfolios. *The Clinical Teacher*, *7,* 187–91. https://doi.org/10.1111/j.1743-498x.2010.00364.x.

Busch, C. M., & Gilbertson, L. (2024). Analysis of eportfolio data to inform curriculum review and redesign. *Practitioner Research in Higher Education Journal Online First*, 35-48.

Analysis of eportfolio data to inform curriculum review and redesign | Practitioner Research in Higher Education (cumbria.ac.uk).

Centenary Commission on Adult Education (2019). *"A permanent national necessity…" Adult Education and Lifelong Learning for 21st Century Britain*. The Centenary Commission on Adult Education. https://centenarycommission.org/wp-content/uploads/reports/The-Centenary-Commission-on-Adult-Education-Report-LOW-RES.pdf

Csikszentmihalyi. M., & Rochber-Halton, E. (1981). *The meaning of things. Domestic symbols and the self*. Cambridge University Press.

Chan, C. K. Y., & Lee, K. K. W. (2021). Reflection literacy: A multilevel perspective on the challenges of using reflections in higher education through a comprehensive literature review. *Educational Research Review, 32*. https://doi.org/10.1016/j.edurev.2020.100376.

Chiang, Y. V., Chang, M., & Chen, N.-S. (2024). Can generative AI help realize the shift from an outcome-oriented to a process-outcome-balanced educational practice? *Educational Technology & Society, 27*(2), 347–385. https://www.jstor.org/stable/48766179.

D'Souza, I., Sapsed, C., & Volcic, Z. (2025). Connecting through e-portfolio practice: Trust, relationships and expertise. *Journal of University Teaching and Learning Practice*, *22*(3). https://doi.org/10.53761/bxbz1s87.

Deci, E. L., & Ryan. R. M. (2011). Self-Determination Theory. In Van Lange, P.A.M, Kruglanski, A.W. and Higgins, E.T. (eds) (2011). *Handbook of Theories of Social Psychology: Collection: Volumes 1 and 2*. SAGE Publications, 416-437.

Dixon, P. (2024). *How AI will change your life*. Profile Books.

Dobson, S., & Walmsley, B. (2021). Fail fast, fail often…but don't fail this course! Business and enterprise education through the lens of theatre and the creative arts. *Industry and Higher Education*, *35*(4), 336-346. https://doi.org/10.1177/0950422220955071

Driessen E, van Tartwijk J, van der Vleuten C, & Wass V. (2007). Portfolios in medical education: why do they meet with mixed success? A systematic review. *Medical Education*. *41*(12), 1224-1233. https://doi.org/10.1111/j.1365-2923.2007.02944.x

Dunbar-Morris, H., Nerantzi, C., Sidiropoulou, M. P., & Sharp, L. (2023). Exploring (in)dependent learning in a cross-institutional project about perceptions of learning. *Distance Education, 44*(2), 380–400. https://doi.org/10.1080/01587919.2023.2198492

Ehlers, U.-D., & Eigbrecht, L. (Eds) (2024). *Creating the university of the future. A global view on future skills and future higher education. Zukunft der Hochschulbulding*. Future Higher Education. Springer. https://doi.org/10.1007/978-3-658-42948-5.

Ehlers, U.-D., Lindner, M., & Rauch, E. (2024). *AIComp Future skills for a living and working world shaped by AI. Research report 2: Empirical construction and description of the competence model AIComp. Next Education. Making tomorrow*. https://next-education.org/downloads/2024-06-13-AIComp-Part_2_-_Competencemodell_Eng-final.pdf.

Ehlers, U-D. (2020). *Future Skills. The future of learning and higher education*, translated by Ulf-Daniel Ehlers, Patricia Bonaudo, Laura Eigbrecht Karlsruhe. https://nextskills.org/library/future-skills/.

Ehlers, U-D. (2024). Towards a Future Skills Framework for Higher Education. In: Ehlers, UD., Eigbrecht, L. (eds) *Creating the University of the Future. Zukunft der Hochschulbildung -*

Future Higher Education. Springer VS, Wiesbaden. https://doi.org/10.1007/978-3-658-42948-5_2

EU Commission (2000). *Memorandum on Lifelong Learning*. https://arhiv.acs.si/dokumenti/Memorandum_on_Lifelong_Learning.pdf.

European University Association (2021). *Universities without walls. A vision for 2023. Brussels*. https://eua.eu/downloads/publications/universities%20without%20walls%20%20a%20vision%20for%202030.pdf.

Fisher, M.B., & Wheeler, P. (2025). Reimagining a pedagogy of care using ePortfolios as a scholarly, 'visibility' tool in higher education. *Journal of University Teaching and Learning Practice*, *22*(3). https://doi.org/10.53761/tw9qf308.

Freire, P. (2011) *Pedagogy of the oppressed*. Continuum.

Guillaumier, C. (2016). Reflection as creative process: Perspectives, challenges and practice. *Arts and Humanities in Higher Education*, *15*(3-4), 353-363. https://doi.org/10.1177/1474022216647381.

Hall D. (1992). Professional development portfolios for teachers and lecturers. *Journal of In-Service Education*. *18*(2). 81–86. https://doi.org/10.1080/0305763920180203.

Harris, R. (1998). *Introduction to creative thinking*. http://www.virtualsalt.com/crebook1.htm.

Jackson, N. J. (2011). Chapter 1: The lifelong and lifewide dimensions of living, learning and developing. In N. J. Jackson (ed.). *Learning for a Complex World: A lifewide concept of learning, education and personal development*. 1-21. https://www.lifewideeducation.uk/learning-for-a-complex-world.html

Jackson, N. J., & Barnett, R. (2019). Introduction; Steps to ecologies for learning and practice. In R. Barnett and N. Jackson. (2019). *Ecologies for learning and practice: Emerging ideas, sightings, and possibilities*. Routledge.

James, A., & Brookfield S. (2014*). Engaging Imagination. Helping Students become creative and reflective thinkers*. Jossey-Bass.

Jancovich, L., & Stevenson, D. (2021). Failure seems to be the hardest word to say. *International Journal of Cultural Policy. 27*(7), 967–981. https://doi.org/10.1080/10286632.2021.1879798.

Jisc (2025, May 21). *Student perceptions of AI.* https://nationalcentreforai.jiscinvolve.org/wp/2025/05/21/student-perceptions-of-ai-2025/

Kessels, E. (2016). *Failed it! How to turn mistakes into ideas and other advice for successfully screwing up*. Phaidon Press.

Khasawneh, M. A. S., Aladini, A., Assi, S. A. *et al.* (2025). Portfolio assessment in AI-enhanced learning environments: a pathway to emotion regulation, mindfulness, and language learning attitudes. *Lang Test Asia. 15*(5). https://doi.org/10.1186/s40468-025-00345-0.

Kleiman, P. (2009). *Design for learning: a guide to the principles of good curriculum design, Palatine working paper*. https://drive.google.com/file/d/15DhS2jexxthZMbBybSsGjlnSVe1t5leP/view.

Kotsiou, A., Fajardo-Tovar, D. D., Cowhitt, T., Major, L., & Wegerif, R. (2022). A scoping review of Future Skills frameworks. *Irish Educational Studies. 41*(1), 171–186. https://doi.org/10.1080/03323315.2021.2022522.

Lu, H. (2021). Electronic Portfolios in Higher Education: A Review of the Literature. *European Journal of Education and Pedagogy*. *2*(3), 96–101. https://doi.org/10.24018/ejedu.2021.2.3.119.

Matson, J. O. (2025, May 19). Beyond Augmentation: Toward a Posthumanist Epistemology for AI and Education. *Intralation: Culture, Theory, Pedagogy*. https://intralation-culture-theory-posthuman-pedagogy.ghost.io/beyond-augmentation-toward-a-posthumanist-epistemology-for-ai-and-education/.

Mogas, J., Cea Álvarez, A. M., & Pazos-Justo, C. (2023). The Contribution of Digital Portfolios to Higher Education Students' Autonomy and Digital Competence. *Education Sciences. 13*(8), 829. https://doi.org/10.3390/educsci13080829.

Mohamad, S. N. A., Embi, M. A., & Nording, N. (2016) Designing an E-Portfolio as a Storage, Workspace and Showcase for Social Sciences and Humanities in Higher Education Institutions (HEIs). *Asocial Social Science*. *12*(5). 185-194. https://doi.org/10.5539/ass.v12n5p185.

Nasrallah, M. (2020). We can't go back to 'wild academism' after this crisis, 1 May 2020, *Times Higher Education*. https://www.timeshighereducation.com/blog/we-cant-go-back-wild-academism-after-crisis?utm_source=THE+Website+Users&utm_campaign=f24f95e947-EMAIL_CAMPAIGN_2020_04_30_02_38&utm_medium=email&utm_term=0_daa7e51487-f24f95e947-60045193.

Nerantzi, C. (2022). Towards defining uncreative teaching as an act of normalised open educational practice and the ethical sharing of pedagogical ideas. A provocation.

International Journal of Open Schooling (IJOS), *1*(1), pp. 53-68. https://www.nios.ac.in/media/documents/IJOS/articles/IJOS_Ch-13.pdf.

Nerantzi, C. (2024, July 4). Digital portfolios as flying containers with open windows, Media & Learning Association. https://media-and-learning.eu/subject/av-technologies/digital-portfolios-as-travelling-containers-with-open-windows/.

Nerantzi, C., & Thomas B. E. (2019). What and who really drives pedagogic innovation?. In: Elkington, S., Westwood, D. and Nerantzi, C. (eds.) Creativity in Student Engagement, Special Issue, *Student Engagement in Higher Education Journal*. *2*(3), pp. 234-260. https://sehej.raise-network.com/raise/article/view/1009.

Nerantzi, C., Sidiropoulou, M. P., Dunbar-Morris, H., Sharp, L., Farrell-Savage, K., Heard-Lauréote, K., Speight, S., Nawaz, R., & Ali, M. (2023). There are other fish in the sea: Open-up and connect. In Harrison, M., DeVries, I., Morgan, T. & Paskevicious, M. (eds.) (2023) *Re-think learning design. Critical learning design and the untextbook*. https://rethinkld.trubox.ca/chapter/activation-there-are-other-fish-in-the-sea-open-up-and-connect/.

Neves, J., Freeman, J., Stephenson, R., & Sotiropoulou, P. (2024). Student academic experience survey 2024. *Advance HE and HEPI*. https://advance-he.ac.uk/knowledge-hub/student-academic-experience-survey-2024?utm_campaign=uk-uk-tal-insights-saes-linkedin-24jan25&utm_medium=social&utm_source=LinkedIn.

Ni, Y., & Lam, R. (2025). Students' perceptions of multiliteracies development using AI-assisted portfolio assessment. *Pedagogies: An International Journal*, 1–28. https://doi.org/10.1080/1554480X.2025.2545212.

OECD (2019). *Future of education and skills 2030*. OECD Learning compass 2030. OECD. https://www.oecd.org/content/dam/oecd/en/about/projects/edu/education-2040/1-1-learning-compass/OECD_Learning_Compass_2030_Concept_Note_Series.pdf.

OECD (2025). *Introducing the OECD AI Capability Indicators*, OECD Publishing. https://doi.org/10.1787/be745f04-en.

Paulson, F. L., Paulson, P. R, & Meyer, C. A. (1991). What Makes a Portfolio? *Educational Leadership*, *48*(5), 60-63. https://go.openathens.net/redirector/leeds.ac.uk?url=https://www.proquest.com/trade-journals/what-makes-portfolio/docview/224851982/se-2

Quinn, P. (2024). e-portfolios as authentic assessment tools. *Media and Learning Association*. June 2024. https://media-and-learning.eu/subject/higher-education/e-portfolios-as-authentic-assessment-tools/.

Reddecker, C., Leis, M., Leenderstse, Punie Y Gijsbers G., Kirschener P., Stoyanov, S., & Hoogveld B. (2011). The Future of Learning: Preparing for Change. *JRC European Commission, Scientific and Technical Reports*. https://dx.doi.org/10.2791/64117.

Renwick, M. (2021). *Three ways digital portfolios shift your assessment focus*, March 2021. https://www.teachingchannel.com/k12-hub/blog/digital-portfolios/.

Samuels, M., & Betts, J. (2007). Crossing the threshold from description to deconstruction and reconstruction: using self-assessment to deepen reflection' *Reflective Practice. 8*(2), 269–283. https://doi.org/10.1080/14623940701289410.

Sankey, M. (2025). ePortfolio traditions that are ready to be broken and new ones ready to be established. *Journal of University Teaching and Learning Practice. 22*(3). https://doi.org/10.53761/c2tcmt21.

Sarmiento, J. (2004). Showcase vs. Emerging Portfolios: Capturing Practice and Reflection of K-12 Practitioners through Authentic Engagement in Online Communities. In R. Ferdig, C. Crawford, R. Carlsen, N. Davis, J. Price, R. Weber & D. Willis (eds.). *Proceedings of SITE 2004. Society for Information Technology and Teacher Education International Conference.* pp. 235-237). Association for the Advancement of Computing in Education (AACE). https://www.learntechlib.org/primary/p/11981/ .

Schön, D. (1983). *The reflective practitioner. How professionals think in action.* Basic Books.

Seaman, J. (2008). Experience, Reflect, Critique: The End of the "Learning Cycles" Era. *Journal of Experiential Education. 31*(1), 3-18. https://doi.org/10.1177/105382590803100103.

Sipos, Y., Battisti, B., & Grimm, K. (2008). Achieving transformative sustainability learning: engaging head, hands and heart. *International Journal of Sustainability in Higher Education. 9*(1), 68-86. https://doi.org/10.1108/14676370810842193.

The Centenary Commission on Adult Education Report. (2019). *A Permanent National Necessity – Adult Education and Lifelong Learning in C21 Britain.* University of Nottingham. http://doi.org/10.17639/nott.7027.

UNESCO (2006). *Education for all: literacy for life. EFA global monitoring report*. UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000141639.

UNESCO (2022). *The 2019 UNESCO Recommendation on Open Educational Resources (OER): supporting universal access to information through quality open learning materials*.

UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000383205?posInSet=8&queryId=a2ef199f-3c2f-4ca8-abcb-1c685737ee72.

UNESCO (2023a). *International trends of lifelong learning in higher education, Research report. Education 2030*. UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000385339?s=03.

UNESCO (2023b). *Global education monitoring report summary, 2023: technology in education: a tool on whose terms?* https://doi.org/10.54676/HABJ1624.

UNESCO (2024a). *Dubai Declaration on Open Educational Resources (OER): digital public goods and emerging technologies for equitable and inclusive access to knowledge*. UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000392271.locale=en.

UNESCO (2024b). *AI Competency framework for teachers*. UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000391104.

UNESCO (2024c). *AI Competency framework for students*. UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000391105.

University of Leeds (2025). Categories of assessment. https://generative-ai.leeds.ac.uk/ai-and-assessments/categories-of-assessments/

World Economic Forum (2025). *The future of jobs report 2025*. World Economic Forum. https://www.weforum.org/publications/the-future-of-jobs-report-2025/.

Yan, Z., & Yang, L. (eds.) (2022). *Assessment as Learning. Maximising opportunities for student learning and achievement. Asia-Europe Education Dialogue*. Routledge.

Zubizarreta, J. (2009). *The learning portfolio: Reflective practice for improving student learning*. John Wiley and Sons.