Project-Based Learning for Sustainable Development: An Open Educational Research Framework for Design

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Abstract
Education systems around the world are struggling to transform to better engage students in all their diversity, incorporate and adapt to transformative technology, build real-world sustainability competencies, and recalibrate to provide an education that is relevant for rapidly evolving circumstances. Project Based Learning is an approach to both K-12 and adult education that is designed to extend beyond knowledge acquisition and into competency development, enabling real-world action coupled with a focus on authenticity, inclusiveness, and community impact. This research utilized a literature review to analyze design considerations from a variety of PBL design frameworks and integrate them into a whole, including foundational concepts from Education for Sustainable Development and technology education, such as digital citizenship and emerging guidelines on academic integrity that anticipate and even encourage use of generative AI such as ChatGPT. Digital citizenship, digital academic integrity, project impact analysis, and both sustainability competencies and vision were noted to be underrepresented in previous frameworks.

Keywords: PBL Design, Inclusivity, Digital Citizenship, Generative AI, Education for Sustainable Development

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Introduction

Education reform and adaptation is an ongoing process that helps keep education relevant as the needs of individuals and societies transform over time (Reimers, 2017). Much of the current dialogue on educational reform combine knowledge, skills, attitudes, and values into real-world competencies that meet the evolving needs of individuals, the workforce, and the societies (OECD, 2018). One of the forces transforming society and impacting education is technological transformation. Rapid technological transformation has resulted in a need to extend discussions on technology in education beyond technological utilization and into the f digital citizenship competencies (Jackman et al., 2021) and an understanding of hybrid human-machine composition, academic integrity, and plagiarism in a post-generative AI world (Kumar et al., 2023).

Another important concern is how to embed sustainability competencies across the curriculum. Most countries are now signatories to initiatives to work toward the Sustainable Development Goals (SDGs) and embed Education for Sustainable Development (ESD) throughout K-12 and adult curricula (UNESCO, 2015). As part of SDG 4, there is a need to transform pedagogy to better engage and meet the needs of diverse learners while still supporting attainment of learning goals (UNESCO, 2020).

Project Based Learning (PBL) has been identified as an adaptation that is useful across K-12, university, and adult education age groups and has unique promise for making education more efficacious, inclusive, relevant, and engaging (Mergendoller, 2018). PBL is an inquiry driven, student-centered approach to teaching and learning that involves students solving real world problems; meeting design challenges; exploring abstract questions; conducting investigations; and taking evidence-based positions on real issues (Larmer et al. 2015). PBL teachers support acquisition of disciplinary and interdisciplinary learning goals through a variety of learning activities that include direct instruction organized under an inquiry, typically with significant student voice and choice granted to respond to student diversity (McDowell, 2017). Authentic links between the classroom and real world provide opportunities to engage in real world changemaking while building self-efficacy, resilience, internal locus of control, and socio-emotional competence (Almeida & Steinberg, 2001).

Combining knowledge, skills, and attitudes to create real-world impact means that PBL is increasingly recognized as a model vehicle for transformative 21st century learning incorporating reforms such as sustainability education (UNESCO, 2020). Given increasing recognition that PBL is one of the pedagogies most suited to current reforms, the purpose of this research was to synthesize a range of older PBL design considerations from across the literature and link them to emerging work in digital competencies and digital academic integrity as well as foundational ideas from the literature on sustainability education.

Method

The research question was: What key PBL design dimensions can be synthesized from the diverse range of international PBL frameworks currently being used and how can these be enriched by emerging sustainability and digital competency concepts?

The method of utilizing an analysis of the literature and synthesizing findings into design categories is well established for exploring different facets of PBL such as general PBL design considerations (Kokotsaki et al., 2016), linking cognitive, affective and behavioral

competency frameworks to PBL design (Stolk & Martello, 2018), PBL design for specific age groups such as in adult education (Helle et al., 2006; Melin et al., 2009), and PBL design with particular curricular needs such as for STEM studies across age groups (Erdogan & Bozeman, 2015).

PBL design framework searches were made on academic databases including ERIC, Academic Search Complete (EBSCO), ResearchGate, Education Research Complete, and Google Scholar utilizing keywords PBL design, PBL design framework, project based learning design, and project based learning design framework. The search range was 2000-2023. Additional sources were located in the reviewed papers and books. Sources which did not relate specifically to PBL design were rejected. Key PBL design sources reviewed included: Almeida and Steinberg (2001), Du et al. (2013), Erdogan and Bozeman (2015), Hung (2016), Kokotsaki et al. (2016), McDowell (2017), Melin et al. (2009), Miller and Krajcik (2019), Larmer et al. (2015), Laur (2013), and Stolk and Martello (2018).

The results were combined with foundational ideas from several key texts on Education for Sustainable Development that were created as guidance by the United Nations Educational, Scientific and Cultural Organization (UNESCO) on ESD issues and trends (Leicht et al., 2018), learning objectives (UNESCO 2017), priority action areas and implementation issues (UNESCO, 2020), and recent implementation case studies (UNESCO MGIEP, 2017). UNESCO was chosen as the source for the foundational ESD documents because it is a designated lead agency for ESD by the United Nations as well as by member states (UNESCO, 2015). The decision to keep the number of ESD related documents limited was taken as the objective of this research is simply to provide a launch point for interested teacher-designers. Issues raised by technological innovation such as digital competency and citizenship frameworks and academic integrity frameworks in the post-generative AI world were also incorporated into the categories by searching key technology in education frameworks that align with the SDGs.

This method was used to organize the design concepts found in the in the various literature sources into emergent coded categories then used to generate overarching themes (Creswell, 2012) called design dimensions for the purposes of this research.

Results/Findings

This section discusses the design consideration clusters synthesized from the reviewed literature.

Target Knowledge, Skills, Attitudes & Values as Competencies at the Center of Design

There is agreement across the PBL design frameworks that design should start with the learning goals as competencies composed of some combination of knowledge, skills, values, and attitudes rather than knowledge acquisition alone (Almeida & Steinberg, 2001; Larmer et al., 2015; McDowell, 2017). Curricular alignment between these learning goals and every phase of a project serves to keep the focus on learning goal development over engagement in interesting activities that do not result in required learning. As with the backward design process used by Wiggins and McTighe (2005), Melin et al. (2009) note that these learning goals give rise to the assessment strategies and learning activities in PBL and that it is important that both teachers and students remain clear that the purpose of the project is to achieve the learning goals, not to produce a product.

PBL designers may give coherence and meaning to the learning goals by interweaving them under the central big ideas of a disciplinary or interdisciplinary unit (Miller & Krajcik, 2019). As well as the affordances provided by PBL in supporting multi/interdisciplinary studies, project management and socio-emotional learning goals are important targets (Larmer et al., 2015). This is particularly so when embedding an ESD orientation as many of the necessary skills and attitudes come from the development of empathy, compassion, affective regulation during conflict, conflict resolution, and their contributions to collaboration, self-awareness, and normative competencies (UNESCO, 2017). Utilizing frameworks such as Education 2030 (OECD, 2018) that differentiate target knowledge, skills, attitudes, and values that compose competencies can help designers clarify non-disciplinary learning goals.

Authenticity, Contexts of Learning, & Sustainability Vision

Authenticity is a central consideration in PBL design because it is part of what supports student buy-in, engagement, and perseverance as authenticity helps link learning to ideas and issues that are important to students (Mergendoller, 2018). It therefore provides both a contextual hook and a sense that the understandings being developed are meaningful and transferable throughout the lifespan (Miller and Krajcik, 2019). From an ESD perspective it teaches how to create real world change. Almeida & Steinberg (2001) place authenticity at the top of their 6A's of design and assess it by asking whether the project investigates an issue that is meaningful for the students, whether it is representative of tasks that real people in a target community do, and whether the project results in value beyond the school setting. To ensure authenticity Laur (2013) includes linking the investigation to a clear community or career connection in her framework. Melin et al. (2009) also note that high authenticity increases perceived relevance and was central to student and faculty perceptions when ranking projects in their adult education context.

Considering study contexts that range from local to global such as different geographical, cultural, and identity levels, offers the opportunity to examine issues holographically, such as water quality in the community, across the nation, and internationally so that a deeper understanding can be developed as well as an appreciation of systems approaches which, especially when used with anticipatory competency or future thinking, is important for sustainability education (UNESCO, 2017). Considering and valuing multiple levels of identity and action that span the personal, local, regional, national, global is articulated in the Education 2030 competency framework (OECD, 2018) and is an important overarching feature of sustainability oriented education in part because it may support a sense of connectedness and therefore a sense of being an active and invested citizen with both an opportunity and a responsibility to contribute to solutions to problems at these various levels (Leicht et al., 2018).

Although related to both authenticity and contexts of learning, the sustainability vision design dimension is about combining authentic issues, empathy, systems thinking, notions of interdependence, and local-global realities into a changemaking stance. Although ESD goes far beyond exploring the SDGs, they are a common entry point to help organize concepts for teachers and students (Rieckmann, 2018). Another entry point for sustainability vision is through themes, such as homelessness, school garden projects, or social enterprise design which relate to SDGs but may be more accessible (UNESCO, 2017). This dimension can add meaning and Hung (2016) describes the process of students taking ownership over projects and becoming affectively involved in them through exposure to course content but also to

situations, people, places, or things that engage both them both intellectually and emotionally.

Intellectual Challenge, Depth of Inquiry, & Structure

Intellectual challenge and accomplishment is implied by utilizing grade appropriate learning outcomes. However, Laur (2013) and other PBL designers note that this dimension goes beyond meeting an adequate standard and expresses the vision of students striving to achieve the highest possible quality of work from an internally located sense of motivation. Mergendoller (2018) expresses the need for depth over breadth and to "grapple with the concepts and understandings fundamental to the subject and discipline" (pg.3). However, deep thinking is not guaranteed to happen without support and this process of thinking about content is supported by learning to talk about thinking, notice opportunities for different kinds of cognition and metacognition, and engage in the appropriate kinds of thinking for a given task (Ritchhart et al., 2011).

Of course, it is important to make sure that the challenge is appropriate to the age group and supported through the application of teacher coaching, direct instruction, and other scaffolds (Miller & Krajcik, 2019). It is also part of the PBL ethos that the process is more important than final products as there are many valuable investigations to be done on topics for which there are no perfect solutions (Hung, 2016). McDowell (2017) argues that PBL shows weak efficacy in content learning if applied when students are developing foundational knowledge in an area and are not given support. He suggests recognizing the difference between surface learning, deep learning, and transfer learning and structuring the PBL program accordingly, with sufficient support early in the process and progressively deeper intellectual challenges to create mastery of foundational knowledge and eventual intra-interdisciplinary transferable competence over time.

Project-based learning is an approach to teaching and learning that is driven by ongoing inquiry with an emphasis on students formulating new subquestions as opposed to the remembering of answers (Almeida & Steinberg, 2001). The challenging question or problem is a therefore a key characteristic of project and problem-based learning and is one of the pivotal design considerations across frameworks. The inquiry is framed with a question to create the initial inquiry and is often called the driving question, inquiry question, problem statement, or research question (Hung, 2016; Larmer et al., 2015; Mcdonnell, 2017). Hung (2016) argues that the structure of the question or problem statement must be deliberately and carefully designed as one of the core design tasks which shapes the entire learning experience. Helle et al. (2006) note that it is crucial that the prior knowledge of the students is not sufficient for them to answer the question in a single research effort, forcing a cascade of questions to be generated to drive ongoing inquiry. Miller and Krajcik (2019) state that the question or problem should also have many possible ways to solve it acceptably.

Key Artifacts of Learning & Meaningful Audience

This design dimension considers both the product and the audience, as well as how the two will be brought together (such as in online versus offline). This is a process which Laur (2013) describes as creating a meaningful outside audience. Although presenting projects to school peers and parents is better than no public audience, Laur (2013) suggests genuine stakeholders relating to the project such as community members, professionals in the field, local to international organizations, and others who have knowledge of the project inquiry

area, provide the benefit of having a stake in the outcome and, preferably, the capacity to instigate change based on the project findings.

Public products (Larmer et al., 2015) or learning artefacts (Helle et al., 2006) are well known features of PBL. Combining a meaningful audience with authentic learning artifacts generates the potential to create real world change through interaction with parents, the community, local and national governments, corporations, and other organizations. As well as making learning meaningful, the potential to create real impact is part of what makes PBL a unique vehicle for Education for Sustainable Development (UNESCO, 2020).

Student Voice, Choice, Diversity & Inclusion

Student voice describes the ability for students to express their ideas both in terms of content and how a project proceeds through debate, consensus building, and democratizing the classroom (Helle et al., 2006). Student voice, among other affordances, is thought to support students in developing an understanding of the learning process and the ability to discuss, plan, monitor, and support others through that process (McDowell, 2017). Student choice is asks designers to consider where and how projects can be guided by age-appropriate choice. Depending on the needs of the course this can be extremely broad, such as in the case of a project in which students can choose any concept they wish to drive their project, to within-lesson choices about activities, project pacing, and so on (Larmer et al., 2015).

However, Mergendoller (2018) advises that using voice and choice as a design consideration is not meant to imply that choices should always be available and that teachers should force student interaction with key ideas, tasks, or obstacles when appropriate. McDowell (2017) argues that engineering deep thinking on content is central to PBL creating high-impact learning for required disciplinary knowledge and notes that designing to build a culture in which students gain confidence in their ability to guide their own learning is one of the most crucial design features for high-impact PBL. To this end, he argues that students need to be trained to planning, monitoring, and evaluating their learning as a means of creating a class culture of learning and developing the metacognitive processes that will support individuals.

Supporting student inclusion is built into the SDG 4 and a goal of many education systems, though research into curricula demonstrates that it is often not present or overwhelmed by narrow visions of nationalism, communalism, and moral correctness (UNESCO MGIEP, 2017). It is often up to teachers and designers to anticipate how to create an atmosphere of inclusion in their classroom by supporting the voice and choice of students coming from diverse backgrounds, interests, and ability levels, providing appropriate scaffolding, and potentially also by means such as modelling democratic processes, consensus building, and conflict resolution in the classroom.

Layers of Collaboration & Assessment Plan

Kokotsaki et al. (2016) note a collaboration design dimension that highlights the need for considering individual, pair, small group and larger group work. When designing this, Mergendoller (2018) notes the parallels between project work in classrooms and the real world in which team members approach common projects as a true team, developing a synthesis that includes the views and contributions of all team members as well as the potential for outside collaborators such as students in other schools or countries, community members, and subject matter experts. Learning to become effective in different team roles is

also noted by Almeida and Steinberg (2001) who also advocate for the inclusion of adults outside the classroom to be an explicit design consideration.

It is therefore often desirable to create multiphase workflows in which different phases require individual work, pair work, group work, and whole class work that facilitate a mixture of individual accountability, interdependence, equal participation, and social skills (Cheng et al., 2008). These decisions on grouping during different phases of a PBL workflow also mean decisions on formative and summative assessment as the various phases of a workflow can be formally assessed/graded to create accountability or informally assessed to create opportunities to correct misunderstanding as well as uncovering when just-in-time direct instruction is appropriate (Hell et al., 2006). Stolk and Martello (2018) suggest formative assessment should regularly include communication between students and instructors not only on the learning goals but also their relative importance. Direct instruction is a high impact teaching technique and recognized as an important component of PBL when the teacher acts as a subject matter expert to synthesize information, present alternative viewpoints, clarify confusion, or demonstrate skills among other possibilities (Mergendoller, 2018).

Summative assessment can also be spread throughout the project with weightings assigned to various milestones rather than using a single weighting at the end of the project (Larmer et al., 2015). Almeida and Steinberg (2001) suggest that students should be brought into the assessment process by contributing to the success criteria early on and using these criteria as benchmarks throughout. Grades or mastery checks can be assigned to individuals, pairs, small groups, or an entire class depending on the needs of the program (Melin et al., 2009). The design of the assessment structure is also where project management support for students can be instituted by building in checkpoints, milestones, deliverables, process tracking, success criteria, coaching, feedback, and revisions that are transparent and monitored by students as well as teachers (Almeida & Steinberg, 2001).

Technology Use, Digital Citizenship, & Digital Academic Integrity

Many PBL design frameworks do not consider technology use in the design process. Though technology has been documented as highly effective as a tool in PBL classrooms it is important that it be used with clear purpose as a pedagogical tool (Larmer et al., 2015; Laur, 2013; Patton, 2012). For example, a SAMR audit can be used to explore where digital technologies might augment, modify, or redefine learning activities, formative assessments, or learning artifacts (Puentedura, 2010). The most common level of technology use as a design consideration includes both the pedagogical affordances of technology for the project design and the need to build student competency in technology use.

There is also an increasing need to consider digital citizenship in design as this is a dimension that is distinct from decisions on technology use for safe and effective participation in the digital commons (Isin & Rupert, 2015). Becoming aware of digital citizenship frameworks such as the International Society for Technology in Education (ISTE) or Digital Quotient (DQ) frameworks can allow designers to choose what components to integrate into projects. For example, DQ offers an aggregate of digital competencies for international use from across a spectrum of technological competency frameworks and agreed upon by numerous international bodies (Jackman et al., 2021). These are both examples of useful frameworks to consider in the design process as they are research-based and already linked to the SDGs for sustainability vision.

Though academic integrity may not at first seem to belong with this design dimension, researchers such as Kumar et al. (2023) note that new technologies such as generative AI have resulted in dramatic changes to how academic integrity must be dealt with. Eaton (2023) also raises the issue of normalization of hybrid human-machine composition and the ramifications of this including the need for fact-checking AI composition, modifications to attribution and plagiarism policy, and the necessity of an overall understanding of human responsibility for finished products.

Revision, Reflection, Criticality, and Reflexivity

Planning for critique, revision, and reflection cycles in PBL is found across frameworks PBL. Due to the sustained nature of PBL it requires checks at set points in the project to ensure progress is on track and to cement learning (Larmer et al., 2015) as well as to support revision (Kokotsaki et al., 2016). Miller and Krajcik (2019) further note the links between these iterative cycles of improvement and both national science standards and the scientific paradigm PBL is rooted in. Feedback for revision can come from the teacher, peers, be self-critique, or come from other sources that have been incorporated into a project such as mentors or community members (Almeida & Steinberg, 2001). McDowell (2017) suggests that students be given instruction and protocols for providing effective feedback based on success criteria for the depth of learning that is being targeted (surface, deep, transfer).

This design cluster highlights the need to plan when and how students will be guided to reflect to cement their learning throughout the PBL experience, which is distinct from the critique and revision of work for higher quality (Almeida & Steinberg, 2001). Helle et al. (2006) note that systematic reflection on learning has become a defining feature of modern PBL. However, efforts for effective reflection are difficult without criticality. Criticality is central to Education for Sustainable Development as it allows people to take a variety of perspectives that are necessary for comprehensive analysis of issues and impacts, such as those of different stakeholders; present and future; local, national, and global, and so on (UNESCO, 2017). Although criticality in terms of critical thinking and problem solving may be generally encouraged, applying a critical stance toward society, dominant economic systems, nationalist narratives, education systems, or the classroom environment itself are often not included in critique though they are important components criticality in ESD (UNESCO MGIEP, 2017). Importantly, Rieckmann (2018) suggests actively critiquing contradictions in ESD. Criticality is therefore a key sustainability competency but is a more complex design consideration than problem solving alone (UNESCO, 2017).

Reflexivity is the critical examination of one's own feelings, thoughts, biases, and beliefs and is therefore a precondition for effective criticality and also a crucial component of ESD (Leicht e al., 2018) that contributes toward normative and self-awareness competencies (UNESCO, 2017). UNESCO MGIEP (2017) has noted that truly transformative education is unlikely to be successful or impactful without a commitment to criticality that is supported by reflexive self-awareness.

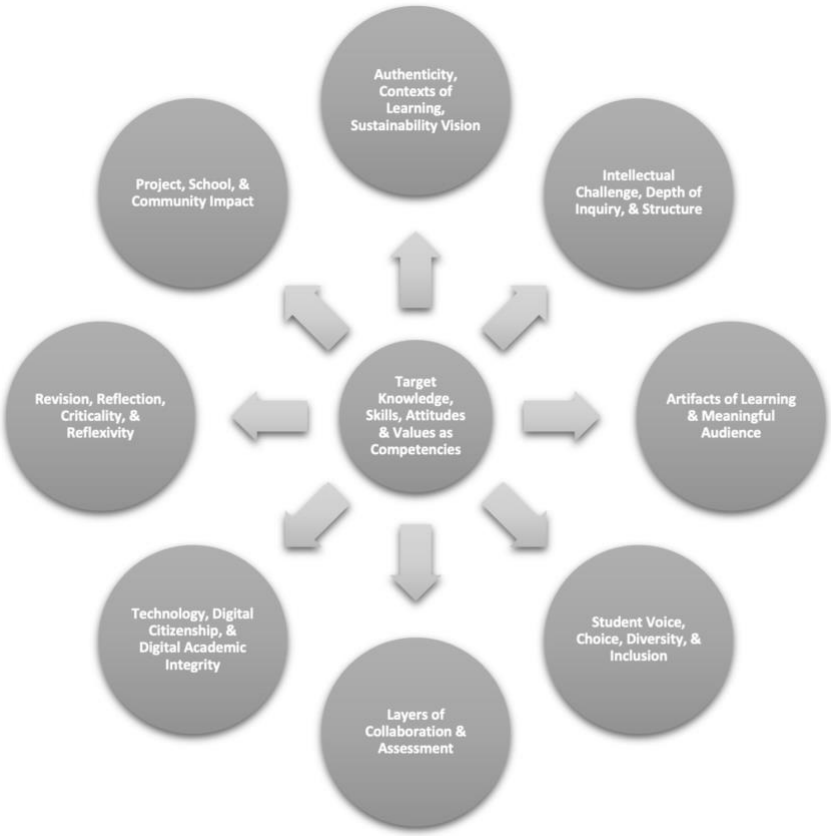
Project, School, and Community Impact

Designing to optimize project impact on the students is an important feature of ESD and is articulated as through the descriptions of strategic competency, integrated problem-solving competency, and anticipatory competency (UNESCO, 2017). Development of all these competencies requires the use of action-oriented, learner-centered pedagogies (Leicht et al.,

2018) such as PBL. However, Almeida and Steinberg (2001) note that a distinct element is planning for and assessing the impact on the school, as quality PBL can create transformation for schools and school systems as all school stakeholders transform through ongoing cycles of planning, execution, and evaluation. This can include analysis of impact on school staff and organizational function. Rieckmann, (2018) notes that this can result in a transformation of schools into role-models known as a whole-institution approach in ESD.

Community impact, whether in a local, regional, global or digital context is a particularly noteworthy design consideration for Education for Sustainable Development (UNESCO MGIEP, 2017). Miller and Krajcik (2019), raise the issue of planning for community impact in the design considerations, particularly regarding the public product and audience. Laur's (2013) design framework goes further and includes an analysis and justification of any proposed or enacted solutions that students must develop during the PBL experience (in this case focused on K-12 students). This justification needs to be critical, occur throughout the project both as proposals and milestone completions, and involve an audience outside the classroom.

Figure 1:*Global PBL Design Cluster Framework*



Discussion

Overall, this research found congruence between frameworks different for PBL design, with major differences being in emphasis. For example, some frameworks are more concerned with fostering real-world competencies and connections (Almeida & Steinberg, 2001) while others emphasize disciplinary learning goal attainment (McDowell, 2017). Learning goals as the start point for design, authenticity, public products, inquiry questions, student voice,

collaboration, revision, and reflection are design considerations that appear across the frameworks and are integral to PBL.

Technological considerations in design were not well represented in the literature reviewed and the design cluster of technology, digital citizenship, and digital academic integrity is an important addition. Technological considerations need to move beyond teaching students to use technology or using technology for its pedagogical affordances, although these remain one feature of the cluster. Digital citizenship is an increasingly important and contested area of our social commons with unique opportunities and dangers which deserve explicit consideration in design (Isin & Ruppert, 2016). Digital competency frameworks are useful reference points for desingers. Similarly, new ways of thinking about composition, human-machine collaboration, plagiarism, and academic integrity are rapidly emerging (Kumar et al., 2023). These should be key considerations rather than an afterthought.

ESD design considerations were also poorly represented in the literature, though overlap in the areas of critical thinking and real-world action were noted. In providing additional depth for ESD, this research has only attempted to scratch the surface. Given the combination of pressing need and education policy directives, much more work needs to be done in capacity embedding ESD into all curricula (UNESCO, 2020). An excellent starting point for interested designers and teachers would be an examination of ESD learning objectives (UNESCO, 2017) and the implementation roadmap (UNESCO, 2020).

Impact planning and assessment emerged as a final cluster that was under-represented in the literature (excepting Almeida & Steinberg, 2001), but extremely important in the ESD literature as part of the anticipatory and strategic competencies (UNESCO, 2017). Including students in this process can help to clarify the difference between problem solving (generating potential solutions to a problem) and assessing how different solutions may impact different stakeholders. Linking this with critical pedagogy may further assist as a given “project solution” may impact more and less vulnerable stakeholders differently. Considering project impact on students and other stakeholders supports both a nuanced perspective and may result in enriching community discussions with stakeholders, empathy, and the avoidance of overly simplistic solutions that negatively impact vulnerable stakeholders, whether in the community or in a school.

Conclusion

Previous works note that there needs to be a reorientation of the learning goals and pedagogies to those that support peace, sustainability, civics. and problem solving for our shared challenges as a species (Reimers et al., 2016). There are numerous converging forces creating pressure for educational reform. These include the need to engage diverse students in inclusive education systems that create real world competencies (Almeida and Steinberg, 2001; Larmer et al., 2015). It includes rapid technological transformation and its affordances for learning, but also its impact on the need to develop digital citizenship and supporting people through the transition into human-AI hybrid work (Stone et al., 2016) while fostering academic integrity in schools and workplaces in a post-plagiarism era (Kumar et al., 2023). It also includes the need to foster the knowledge, skills, and values associated with sustainability competencies to support the mitigation of problems such as climate change (UNESCO, 2017). These imperatives need to be decompartmentalized, and PBL offers affordances that make it an option that has already been identified as a model to transform

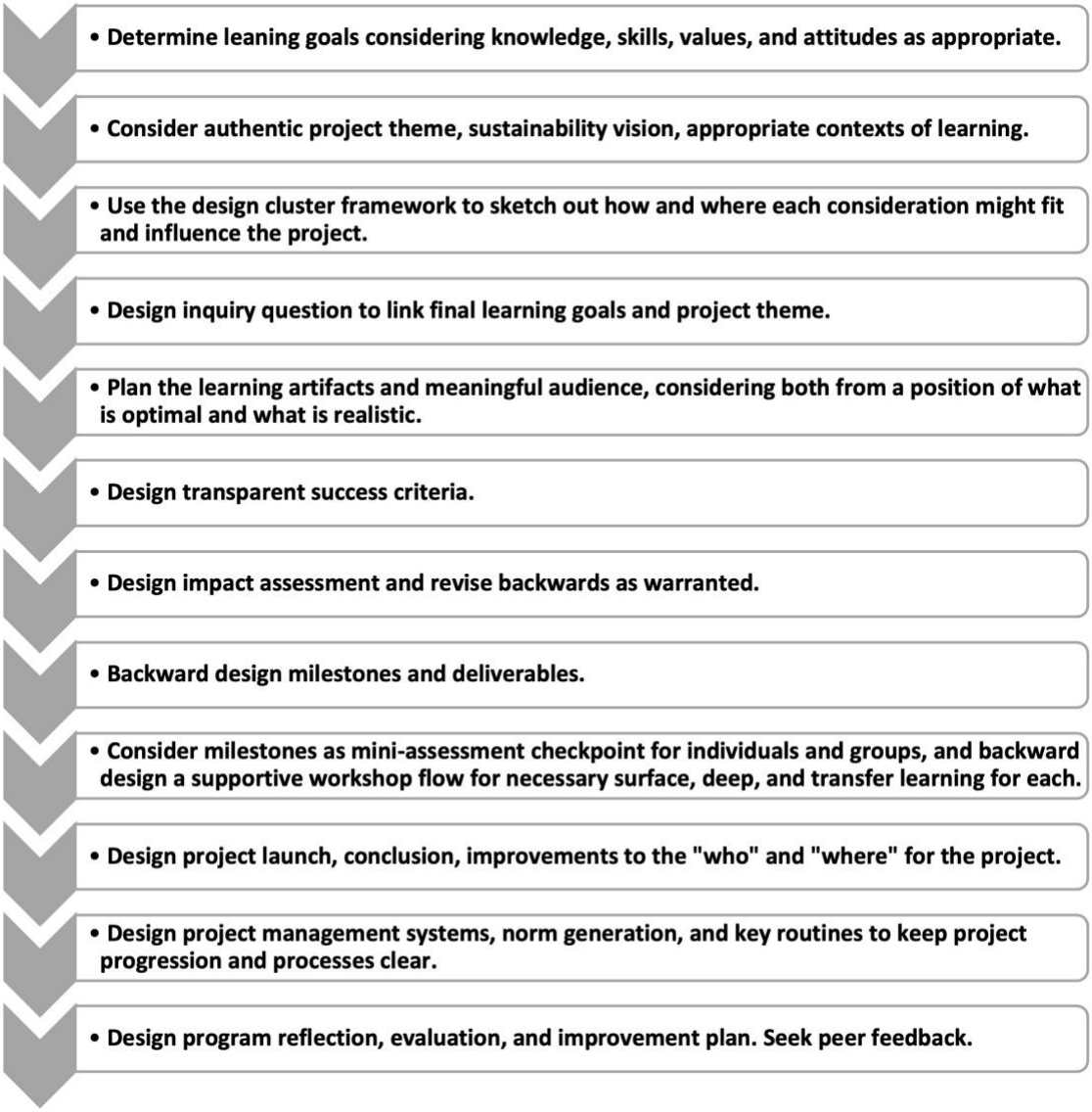
education to a more relevant system and support progress toward the Sustainable Development Goals (UNESCO, 2020).

Embedding ESD across curricula and transforming programming to stay relevant in a rapidly changing technological environment requires ongoing adaptation of PBL design frameworks. This paper is intended to contribute to that effort and thereby support research and field practice. There is a need to contextualize PBL design for different contexts and purposes (Du, 2011). As Stolk and Martello (2018) point out, there is no single way to design PBL that is best in all situations as design is always a matter of trade-offs. Similarly, UNESCO (2017) notes there is no single best way of incorporating ESD principles in all contexts. Given these factors, this paper has attempted to draw together some of the important considerations and resources for effective PBL design rather than to advocate for a single way of developing effective PBL.

Appendix A: Sample Design Workflow

Given the need for contextualization in the design process, the following sample design workflow is intended to provide an example of design process using the Global PBL Design Framework. The process can be ordered in different ways and is often iterative in nature.

Figure 2
Sample Design Workflow



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