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## FEATURED ARTICLE

# PBL, Change or Risk Irrelevance: A Friendly Warning

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### Abstract

The world is already facing the consequences of climate change and biodiversity collapse, yet current trends suggest a far more difficult future in which the existence of human civilization is at stake. This commentary addresses the PBL community's lukewarm engagement with sustainability questions with a friendly warning. Unless PBL practitioners and scholars take the full measure of the emergency and change in proportion to the threat, PBL risks becoming irrelevant. Several avenues for changing PBL in a more sustainable direction are suggested, but this commentary is an invitation for all PBL scholars and educators to come together and bring forward ideas to effect change.

**Keywords:** Problem-based learning, Sustainability, Climate change

It was 51 °C in Jacobabad, Pakistan, in May of this year [5]. Due to the precocious and persistent heat, the North Indian wheat harvest, upon which the world was counting to make up for the war-induced shortfall, did not materialize [14]. 44 million people were at risk of extreme hunger over the summer, most of them in Africa [22]. As dire as this sounds, it is only the beginning, at a cool 1.1 °C of warming. We are barreling towards 1.5 °C of warming, which we are likely to exceed within the next 5 years [20], leaving us with precious little options to limit warming to the 2 °C agreed upon in the Paris Climate Accord.

We are not ready for the consequences: up to 1.2 billion people could be forced to migrate by 2050 [6], large parts of the tropics will periodically breach the 35 °C “wet bulb” temperature beyond which the human body cooks from the inside [21], harvests will fail on a global scale, coral and arctic ecosystems will be in terminal decline [7], and if the Thwaites glacier in Antarctica break up, as is now looking possible [1], sea level rises will likely outpace mitigation efforts in coastal cities. If we add the precipitous collapse of biodiversity, the sharp

increase in chemical and plastic pollution in the environment, and the rapid rate of depletion of basic resources necessary for thermo-industrial civilization to function, the window of opportunity to prevent the collapse of organized human society is getting smaller by the year. We are, in fact, trailing quite exactly the predictions made by the *Limits to Growth* report to the Club of Rome in 1972 – which forecast the collapse of civilization around 2030 [13]. Prominent scientists are now warning that we should take seriously the possibility not just of civilization collapse, but the extinction of humankind [10].

It is 2022. According to the Intergovernmental Panel on Climate Change, we have 3 years left to peak CO<sub>2</sub> emissions [7]. Following the *Limits to Growth* report, we have 8 years left to steer away from uncontrolled collapse [13]. It is a planetary emergency. So, what is the PBL community doing? A search through Google Scholar for publications related to PBL since 2021 shows that the majority of current PBL research is unconcerned with preparing students for the present and coming crises. Whereas we cannot know the specific time, place and

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magnitude of individual events ahead of time, the advent of a world in which pandemics, wars, natural disasters and shortages are rife is predictable. Yet it seems that PBL educators and researchers missed the memo about the world being on fire.

There are two arguments that could be made as to why the potential collapse of civilization should not be at the heart of PBL research and practice, but neither stands up to scrutiny. The first argument would be to leave sustainability to the sustainability scientists. Silo thinking is still, unfortunately, a strong force in universities, especially in more traditional institutions which have only recently adopted PBL. Silo'ing is prominent in problem-based medical and health sciences schools in various countries, especially where the more recent expansion of PBL occurred in the last 20 years (e.g [16]). Teaching in silos of single disciplines will leave students with a single, fragmented perspective on the complex challenges our world is facing. Given the urgency of the situation, we suggest that research and education should take alternative approaches in which the multiple dimensions of these complex problems are addressed to help them understand that solutions to these complex problems need an interdisciplinary and transdisciplinary approach. Furthermore, it would be wise to cease thinking of sustainability as its own field, and rather see it as an integral part of everything we teach and research – the very definition of sustainability is that which does not collapse, and we all would prefer our teaching and research to endure.

The second argument is that there is already a lot of research and practice on PBL in sustainability, so we are on the right track and should just carry on at the current pace. Giving due credit to the efforts of colleagues who take sustainability seriously, much sustainability discourse in PBL, especially in faculties of engineering, is fixated on technological and competence-based problem-solving. This leads to a kind of wishful optimism, summarized by an illustrative quote from a planning student cited in [17]: “I really have trust in technology and development. I have a faith in humanity that we can somehow turn it back,” However, there is no technology that can turn back the disappearance of 1 million species, as predicted by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services [8]. Certainly, different technologies and competences will be required for our students' generation to survive and thrive in what is coming, but the required competences have a lot more to do with re-imagining society, economics and politics for a world without economic growth, than the kinds of

techno-centric problem-solving taught in many engineering PBL schools today.

In this paper, we chose to focus on PBL because all the authors are experienced PBL practitioners and researchers representing different “models” of PBL around the world. While we cannot write a commentary of the shortcomings of education as a whole in such a short space, we acknowledge that what is happening in PBL research and practice is a microcosm of what is happening in higher education at large. That is, the systematic *denial* of the true scale and scope of the emergency before us in universities and higher education institutions around the world. Our experience with PBL may therefore be of benefit to concerned educators practicing other pedagogies.

Can PBL practice actually contribute something to the emergency? Yes, we think so. But first, it must be included within a broader sustainable education framework in which every student, in every field, in every university in the world, is familiarized with the analytical framework of planetary boundaries [15]. The United Nations Sustainable Development Goals (UNSDGs), often claimed as the PBL community's anchor point into sustainability, are the result of a consensus among nations. They were left deliberately vague, and internally contradictory – not least because “green growth” does not exist [9]. The UNSDGs are a bit like a Rorschach test: it is easy to see in them what we prefer to see. We could easily make anything PBL-related fit under UNSDG 4, “Quality Education” – but that does not make it sustainable. The planetary boundaries framework offers a better, sobering reality-check necessary for progress towards sustainable education. For instance, a first year undergraduate introductory PBL course in economics should problematize basic assumptions of economics, namely that nature is free and infinite, and pollution is external to the model. A first-year undergraduate medical course could problematize the impact of breaching planetary boundaries on health. For those familiar with the seven-step method for PBL, a step might be added between brainstorming and problem analysis which consists in contextualizing the problem within the planetary boundaries framework. For those more familiar with the project approach to PBL, a project evaluation criteria might be added regarding the project outcome's congruence with the planetary boundaries framework. This does not imply that every problem should be about planetary boundaries, thereby creating another silo. Instead, we mean to suggest that a planetary boundaries analytical perspective could be added to existing

problems, case scenarios and projects. In a sense, we are proposing a methodological amendment to the PBL approach, rather than changing course content to biology and physics. Within the 7-step method, for instance, one might consider a new step, analysing the problem's planetary boundaries, between step 4, problem analysis, and step 5, formulating learning goals. Such a change would be in line with PBL's history of evolution and adaptation [3]. expounded the ways in which PBL has been changing and adapting over the years in response to contextual pressures, pointing to five types of contextual pressures leading to change: the staff, the students, the community stakeholders, the collaborating institutions, and the political context. The environmental and planetary context might constitute a sixth vector for adapting PBL.

Secondly, the well-established educational benefits of PBL, particularly in terms of generating situational interest in students and fostering self-directed learning, can be harnessed towards combatting typical psychological responses to environmental learning: denial and bargaining – but only if this is done within a roadmap to agency and action, without which students fall prone to despair [17]. Here, the different models of PBL can learn a lot from each other, and also from successful action-oriented, socially conscious pedagogies like service learning [4,11]. Problems can be shaped into systemic, critical, interdisciplinary and trans-disciplinary designs that expose humanities students to physical limits and possibilities and technical students to the societal and long-run economic impacts of technological decisions, including the decision to do nothing. Longer problem cycles, borrowing from project and service-learning formats can give students the space to explore the connection between paper problems and real-world impact. We could offer students projects in which they take an active role in and contribute to solving or gaining a better understanding about complex societal challenges, in which they engage with society, in dialogue with societal partners, reconnecting with society and its challenges. By confronting them with authentic real-life complex challenges we might stimulate them to gain a better understanding of the complexity of the problems the world is facing, take responsibility and help them understand that solutions need to cross disciplinary approaches and need to be co-created by multiple stakeholders, students from different disciplines, teachers from different disciplines, but also societal stakeholders, citizens, governmental bodies etc. Projects in which we encourage students to question and reflect on their assumptions and consider the

needs of others, preparing them to contribute to transform society [19]. Instead of teaching scientific and practical knowledge gained within the boundaries of our universities, we could teach students to listen to and have concerns for the problems our world is facing, connecting with society while being there for society [2]. Modest steps towards these goals are being taken. For example, research and practice-based initiatives in some project-based Universities, developing the concept of 'megaprojects' with the aim of getting students to work together across disciplinary boundaries, with external societal actors to address large scale societal challenges [12]. But given the scale and urgency of the problem, change must come faster and reach farther. This will require a paradigm shift in thinking about PBL, in line with what Sterling called the shift towards "Sustainable Education" [18]. PBL educators are particularly well placed to understand and enact such a shift, given PBL's historical anchoring in the educational paradigm shifts of the 1960s and 1970s. PBL was born from a change in thinking about the role of students, teachers and education in a world that demanded more self-direction, critical thinking and social responsibilities, rather than the traditional hierarchies of old (Servant, 2016). The existence of PBL itself demonstrates that great shifts in educational attitudes are possible. Looking back to the historical success of PBL's adoption and spread through higher education, Servant (2016) suggested that key factors for a successful educational revolution include strong leadership willing to create change, favourable political conditions for change (including financial support), and experimental test-beds where new methods can be trialed, adapted and codified, including adding theoretical layers to educational practice through relevant research. In this sense, perhaps PBL does not need to change everywhere all at once, but seek out a new McMaster or Maastricht to pioneer a new approach that others can adapt and spread.

An important element in re-imagining education and the role of PBL is also the rethink how we evaluate and assess the work of students. Assessment of PBL can steer students by including social impact in the evaluation criteria. This is harder to evaluate than factual answers, but much of the research assessment process in national and international grant-awarding bodies is moving in that direction, so we can learn from these organisations. PBL is a teaching philosophy well-suited to adopting new forms of assessment, so it could make space for more peer-evaluations, and perhaps even community-evaluation modeled on action research to focus student attention on agency

and impact. The question of assessment in times of crisis is worthy of a commentary in its own right and we would welcome such a critical piece from assessment scholars.

There is a lot of work to be done to redesign PBL in this direction, which means there is still space for PBL research to contribute meaningfully to the crisis. As such, what PBL researchers should be asking is: how can PBL contribute to building the resilience of students, teachers, programmes and institutions and the societies they exist in, in the face of the “unprecedented, irreversible, and inevitable” [7] changes that are coming our way? The time for ivory towers is well and truly over: science and education must harness their power in service of guiding humanity towards a livable future.

We are not the first to argue this, but we are the first to put it bluntly: if PBL research and practice continue their current trajectory, they risk irrelevance along with everything else that isn't immediately related to surviving the crisis. It is an inconvenient truth, but the faster the PBL community wakes up to reality, the sooner we can roll up our sleeves and pitch in to the fight against disaster.

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