JUTLP
Journal of University Teaching & Learning Practice

Data Analytics Education for Societal Good: Developing Global Competence, Critical Data Literacy, and Critical AI Literacy using a Purpose-Driven Approach

Dr Michael Lang
University of Galway, Ireland

Abstract

This study investigates the integration of purpose-driven learning (PDL) into data analytics education to foster global competence, critical data literacy (CDL), and critical artificial intelligence literacy (CAIL). PDL emphasises intrinsic motivation and aligns educational goals with societal issues, encouraging students to apply their knowledge to real-world challenges. The research engaged 65 undergraduate business students in purpose-driven assignments centred on the UN SDGs. The results indicate that PDL significantly enhanced students' motivation, engagement, and understanding of global issues. Authentic learning was achieved as students applied technical skills to real-world challenges. The study also demonstrated substantial improvements in CDL and CAIL, empowering students to critically assess data and AI tools within ethical and societal contexts. Furthermore, PDL fostered a sense of global citizenship, equipping students with the skills and purpose needed to address complex global problems.

Editors

Section: Special Issues
Senior Editor: Dr Cassandra Colvin
Associate Editor: Dr Navneel Prasad
Guest Editor: Dr Chee Leong Lim

Publication

Received: 23 December 2024
Revised: 16 May 2025
Accepted: 3 June 2025
Online First: 28 January 2026

Citation. Lang, M. (2026). Data Analytics Education for Societal Good: Developing Global Competence, Critical Data Literacy and Critical AI Literacy using a Purpose-Driven Approach. *Journal of University Teaching and Learning Practice, 23*. Online First. https://doi.org/10.53761/2xjchd49

Introduction

Relentless human expansion has led to a convergence of global crises, including climate change, biodiversity loss and deforestation, diseases and pandemics, pollution, mass displacement of refugees, and widening socioeconomic disparities between rich and poor. As the United Nations Development Programme (2020) puts it, we have entered the "Anthropocene" – an era defined by significant human impact on the Earth – necessitating a fundamental re-evaluation of national development trajectories to remediate environmental degradation. Marine and terrestrial ecosystems are approaching critical tipping points, while worsening food and water insecurity threatens global stability. These challenges are perilously pushing the planet's systems to the brink of their limits, and their adverse impacts disproportionately affect vulnerable communities, further exacerbating existing inequalities. Addressing them requires a fundamental paradigm shift towards an economic model centred on sustainability, resilience, and social justice (Fletcher et al., 2024). Higher education has a crucial role to play in this necessary transition. Beyond equipping students with knowledge and preparing them for employment, universities must foster values of social responsibility and global citizenship, encouraging students to apply their skills and talents in ways that contribute to a more just and sustainable world. Simply put, higher education ought to be purpose-driven (Chakraborty et al., 2021) and oriented towards the greater good of society (Ratten, 2023; Wamsler, 2020).

The term "purpose-driven learning" (PDL) has emerged in various contexts over the past two decades. Volkovich et al. (2004) initially defined it as a paradigm for e-learning that adapts to individual learners' goals and motivations. It has also been applied to staff training (Leong, 2014) and healthcare education (Pronovost et al., 2016). In this paper, PDL is used in the sense defined by Moreno (2022), as a pedagogical approach that fosters social-emotional learning and links education to real-world societal issues that align with students' personal interests. As such, this approach shares similarities with problem-based learning (PBL), but goes further by developing a broader range of skills and knowledge tied to a greater purpose, rather than focusing mainly on problem-solving.

PDL emphasises the alignment of teaching and assessment with social, emotional, and professional goals, encouraging lifelong learning and participation. The core idea behind PDL is that when learners partake in activities that are meaningful to them and connected to their life objectives or values, they are more likely to be motivated, engaged, and successful in the learning process (Moreno, 2022). This approach contrasts with traditional education models, which tend to focus on external motivators such as overall grades, test scores, or curriculum coverage (Milner, 2014).

While there is no universally agreed definition of PDL, a growing body of research, particularly from Western higher education contexts, has examined its role in shaping student identity, fostering civic engagement, and enhancing educational equity. For instance, Beatty et al. (2025) explore how purpose development intersects with students' social-emotional growth, while Luedke and Garcia (2024) highlight the importance of purpose-driven educational engagement for historically marginalised students, linking it to culturally responsive pedagogy and racial

equity in U.S. universities. Haski-Leventhal et al. (2022) similarly argue that business education grounded in social impact fosters value-driven learning and responsible graduate outcomes.

Purpose-driven universities aim to make a societal impact by integrating purpose into education and mission. Several prominent institutions have embraced this approach, including Stanford University and Virginia Tech in the U.S. (Stanford, 2019; Camargo, 2016), Saxion University of Applied Sciences in the Netherlands (Holkenborg, 2024), Ashoka University in India (Chakraborty et al., 2021), Tsinghua University in China (Wang & Biswas, 2024), and University of Technology Sydney in Australia (Haski-Leventhal et al., 2020).

The United Nations Sustainable Development Goals (SDGs) typically hold a central place in the agendas of purpose-driven universities. For institutions that have not yet adopted a purpose-driven approach, the imperative to do so is growing. Increasingly, university leaders are under pressure from students, societal expectations, governments, funding bodies, and other stakeholders to align their strategies with these goals. Additionally, the inclusion of SDGs in influential global rankings, such as the Times Higher Education Impact Rankings and QS World University Sustainability Rankings, adds further impetus to embrace this model.

The OECD (2017) Development Co-operation Report highlights the transformative power of the "data revolution" – including trends such as big data analytics, the Internet of Things, cloud computing, and the rise of artificial intelligence (AI) – and its potential to advance the SDGs. However, the report also underscores the urgent need for stronger leadership, greater investment, and collective action to address data gaps and strengthen analytical capacity. Data analytics education is, therefore, an essential resource to progress the aims of the SDGs.

This study contributes to and extends this discourse by operationalising PDL in a data analytics context, a domain not typically associated with purpose-driven approaches. In doing so, it offers a novel framework that integrates PDL with global competence, critical data literacy (CDL) and critical artificial intelligence literacy (CAIL), thereby expanding the reach of PDL into more technical and interdisciplinary domains and underscoring its relevance in addressing real-world societal challenges. The structure of the paper is as follows: First, a literature review synthesises the core principles of PDL, explains its connection to global competence and CDL/CAIL, presents the study's overarching conceptual framework, and sets out the hypotheses explored in this study. Second, the research method is described, including the study context and the methods of data collection and analysis. Third, the key findings are presented and discussed. Finally, the conclusions and main takeaways are summarised.

Review of Literature

Purpose-Driven Learning

Though there is no universally agreed definition of what constitutes PDL, a review of the salient literature reveals a core set of fundamental principles. First, is intrinsic motivation. At the heart of PDL is the notion that individuals learn most effectively when motivated from within, rather than by external factors. This approach taps into learners' innate curiosity, fostering a deeper sense of ownership and engagement in their educational journey (Moreno, 2022; García Serna et al., 2024).

Second is connection to personal values and goals. PDL aligns learning experiences with students' personal values and long-term goals while tailoring the learning process to their individual aspirations. Teachers work closely with students to help them explore how course content relates to their future careers, social impact, or personal growth, thus creating a more meaningful and personalised learning experience (Moreno, 2022; Wang & Biswas, 2024). Third is relevance and authenticity. In PDL, learning is typically connected to real-world societal challenges and opportunities, such as the SDGs. The objective is to demonstrate to students how the knowledge and skills they acquire can be applied in practical situations, thereby enhancing the significance of the learning process (Chakraborty et al., 2021; Naï, 2014; Cross & Congreve, 2021; Saur-Amaral et al., 2023). PDL is an extension of authentic learning, which is typically characterised by relevance, ill-defined problems, sustained exploration of an issue, use of multiple sources and perspectives, team work, and interdisciplinary thinking (Lombardi, 2017; Reeves et al., 2002). Fourth is reflective learning. PDL encourages continuous reflection, prompting students to ask themselves questions such as: "Why is this important to me?", "How does it align with my aspirations?", or "What positive difference can I make to society by applying my skills and knowledge?". Such practices help students remain connected to their purpose throughout their learning adventure (Moreno, 2022; Milner 2014; Lindholm, 2023).

These core tenets are informed by a number of educational and psychological theories. Central to these is Self-Determination Theory (SDT), which emphasises the importance of responsibility, competence, and relatedness in fostering intrinsic motivation (Deci & Ryan, 1985). By encouraging learner autonomy and connecting educational experiences to a sense of social purpose, PDL aligns very closely with SDT principles. Additionally, PDL incorporates aspects of experiential learning (Kolb, 1984), which asserts that learning occurs most effectively through direct experience followed by reflection. While SDT emphasises motivation, experiential learning adds a practical component, because learning has been found to be most effective when grounded in direct experience. This is reflected in PDL's use of hands-on activities that allow learners to engage actively with content in a meaningful way. PDL is also influenced by constructivist learning theory (Narayan et al., 2013), which suggests that learners build knowledge through their experiences. In the constructivist model, students are seen as active agents who shape their learning pathways, driven by personal meaning and purpose. Prior studies show that empowering students through PDL not only enhances their sense of belonging but also leads to greater participation and engagement in learning activities (e.g., García Serna et al., 2024; Luedke & Garcia, 2024; Beatty et al., 2025).

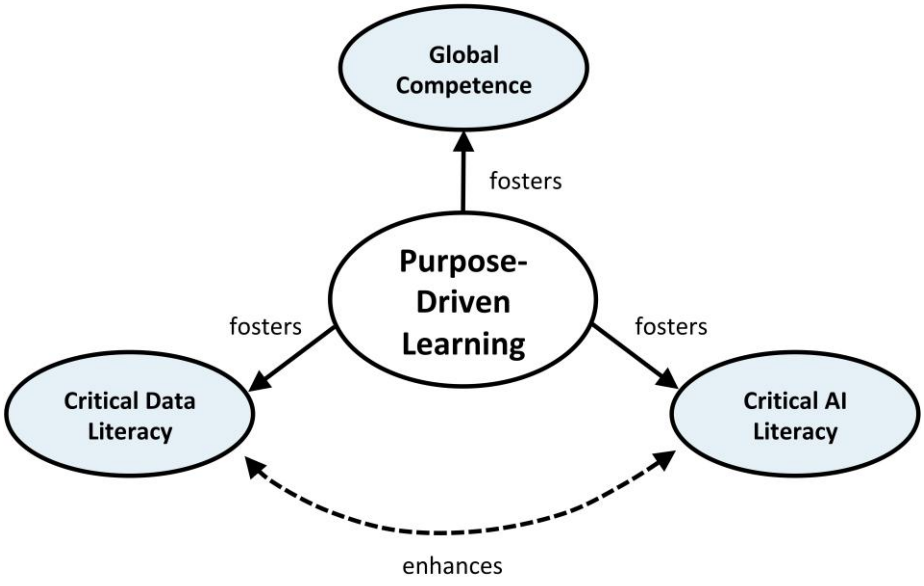
While these theories provide a solid foundation for PDL, their practical application can often be hindered by deeply rooted obstacles and challenges. For example, Naï (2014, p. 5) critiques the educational system in Cameroon and sub-Saharan Africa, attributing its shortcomings in part to the legacy of colonialism, and advocates for a purpose-driven learning approach that addresses students' spiritual, psychological, physical, and social needs to foster development-oriented education. Similarly, Zabenah (2017) highlights the dysfunctions of the U.S. education system and, through an exploratory pilot study, demonstrates that purpose-driven social entrepreneurship programmes can shift high school students' perceptions of success toward service to others, creating a stronger sense of purpose in both school and life in general.

Milner (2014) criticises the overemphasis on assessing teacher performance by means of students' test scores (i.e., results-driven), rather than encouraging students to reflect on societal improvement and find purpose in their holistic learning and existence (i.e., purpose-driven). He asserts that PDL should be designed to encourage students to develop cultural competence and sociopolitical consciousness, so that they go beyond simply absorbing knowledge to critically examine its connections to society. The goal should be for teachers to create environments where students can express their views, gain perspective, and actively participate in discussions by not merely consuming information but also by critically questioning and analysing it. The study described herein adopts a similar viewpoint to Milner (2014), by situating PDL within the confluence of the related concepts of "global competence", "critical data literacy" and "critical AI literacy" (see Figure 1), as explained in the following sections. Given the lack of empirical evaluations of PDL in action, the following hypotheses are proposed:

> **Hypothesis 1:** Purpose-driven learning will result in a strong perception of authenticity and relevance
>
> **Hypothesis 2:** Students who engage in purpose-driven learning will be highly motivated
>
> **Hypothesis 3:** Students who engage in purpose-driven learning will report positive learning experiences

Figure 1

Conceptual Framework



Global Competence

Global competence refers to the ability of individuals to understand, engage with, and navigate the complexities of our interconnected world effectively. It encompasses a range of knowledge, skills, attitudes, and values necessary for individuals to thrive in diverse cultural, social, economic, and political contexts (Li, 2013; Kjellgren & Richter, 2021). PDL closely aligns with

the concept of global competence by encouraging students to focus on broader societal goals and think about how their learning connects to global issues such as sustainability, equity, and social justice (Simpson & Dervin, 2019; Gregersen-Hermans, 2021).

Universities need to assure that their graduates not only acquire professional skills and expertise, but also develop the global competencies necessary to responsibly tackle the issues outlined in the UN's SDGs 2030 Agenda (Haski-Leventhal et al., 2022). Prior research shows that the more that curriculum supports global competence, the more students are equipped to understand and act on global issues, thus aligning with the PDL approach. As an example, Mäntyneva (2022) examined how curricula that promote global competence relate to the various perspectives included in the OECD's PISA 2018 assessment. Analysing the responses of a very large sample of students from 26 countries, he found that curricula with a stronger focus on global competence topics are better predictors of understanding of different perspectives and multicultural awareness. It is therefore hypothesised that:

> **Hypothesis 4:** Purpose-driven learning linked to SDGs will result in a strong sense of g lobal-mindedness.

Critical Data Literacy and Critical AI Literacy

To make informed, evidence-based decisions and recommendations, high-quality data on SDG indicators is essential (Jütting & McDonnell, 2017). The trend towards "data democratization" – which is about making data accessible, understandable, and available to all for the greater good of society (Lefebvre et al., 2021) – has resulted in the publication of vast amounts of open data. This resource is vital as individuals, organisations, and governments collaborate to work towards the SDGs (MacFeely, 2017; Hassani et al., 2021). However, navigating this ever-expanding ocean of big data, which is often rife with misinformation, requires a robust level of critical data literacy (CDL) and, increasingly, critical artificial intelligence literacy (CAIL).

CDL empowers individuals to critically interpret, analyse, and evaluate diverse forms of data in a responsible and informed manner (Lameras, 2023; Cui et al., 2023). This skill is crucial for advancing the SDGs as it enables the purposeful use of data for informed decision-making in key areas such as poverty alleviation, quality education, and climate action. Integrating PDL with CDL affords students the dual benefit of not only gaining data analytics skills, but also learning about the vital role of data in shaping societal outcomes (Louie, 2022; Maybee & Zilinski, 2015). This encourages them to use data responsibly to address important challenges in the modern world, while enhancing their critical thinking and analysis skills (Sander, 2024).

CAIL refers to the ability to understand, evaluate, and engage with AI systems in an informed and ethical manner, recognising their implications for individuals, society, and the world at large (Wang et al., 2023). As AI technologies become increasingly integrated into our daily lives, it is essential for individuals to possess the skills to critically assess their capabilities, biases, and potential societal impacts (Hornberger et al., 2023; Xu & Babaian, 2021). This form of literacy is not just about technical knowledge, but also involves understanding AI's ethical, social, and political dimensions (Laupichler et al., 2023). Linking CAIL to PDL allows students to engage with AI in ways that align with broader social goals.

PDL encourages students to become agents of change. To do so, they should have a grasp of issues such as data quality, representativeness and bias, data modeling and visualisation, and accountability and ethics. CDL and CAIL are therefore mutually reinforcing literacies in the context of PDL. By enabling students to question, critique, and act upon both data and AI systems, they become more informed and active participants in addressing real-world issues (Hornberger et al., 2023). CDL offers students the ability to analyse and question data, while CAIL extends this analysis to AI models that act on that data. PDL integrates these competencies to cultivate sociopolitical consciousness, global competence and awareness of responsible business management practices (Milner, 2014; Haski-Leventhal et al., 2022). It is hypothesised that:

Hypothesis 5: Purpose-driven learning can improve critical data literacy skills

Hypothesis 6: Purpose-driven learning can improve critical AI literacy skills

Hypothesis 7: Critical data literacy and critical AI literacy are strongly linked

Method

Context

In May 2023, the University of Galway was designated as a national SDG Champion by the Irish government's Department of Environment, Climate & Communications. Prior to and following this announcement, significant efforts were made to integrate SDGs into teaching and research activities across all units of the university. An indicator of the success of this strategic imperative is that the 2024 Times Higher Education University Impact Rankings placed the University of Galway first in Ireland, in the Top 3 within the European Union (EU), and in the Top 50 worldwide for its contribution to the SDGs (THE, 2024).

The setting for the research study discussed in this paper was the B.Sc. undergraduate degree in Business Information Systems (BIS) within the School of Business & Economics during the 2023/24 academic year. The programme learning outcomes (PLOs) of the B.Sc. in BIS stipulate that students are expected to be able to solve business, policy and societal problems within a global context, and also be able to make a positive societal impact through critical thinking, innovation, and collaboration. Graduates of the programme are expected to have developed problem-solving skills, creativity, personal responsibility, commitment to life-long learning, respect for ethical and professional standards, integrity, and good citizenship.

Given the major university-wide emphasis on SDGs, and the existing PLOs and intended graduate attributes, the teacher decided to adopt a purpose-driven approach on a course delivered to second- and third-year students, namely "Advanced Database Technologies". This course teaches students how to design, develop and use data analytics technologies such as MongoDB, Python, PowerBI, Tableau and neo4j. Unlike previous years, which focused largely on technical skills development, the approach in 2023/24 emphasised applying these skills in the context of the SDGs. In the introductory session, students were informed: "*You are not here to learn data analytics skills for their own sake; rather, you should think about how to apply these skills for a beneficial purpose, and that purpose will drive your learning on this course*."

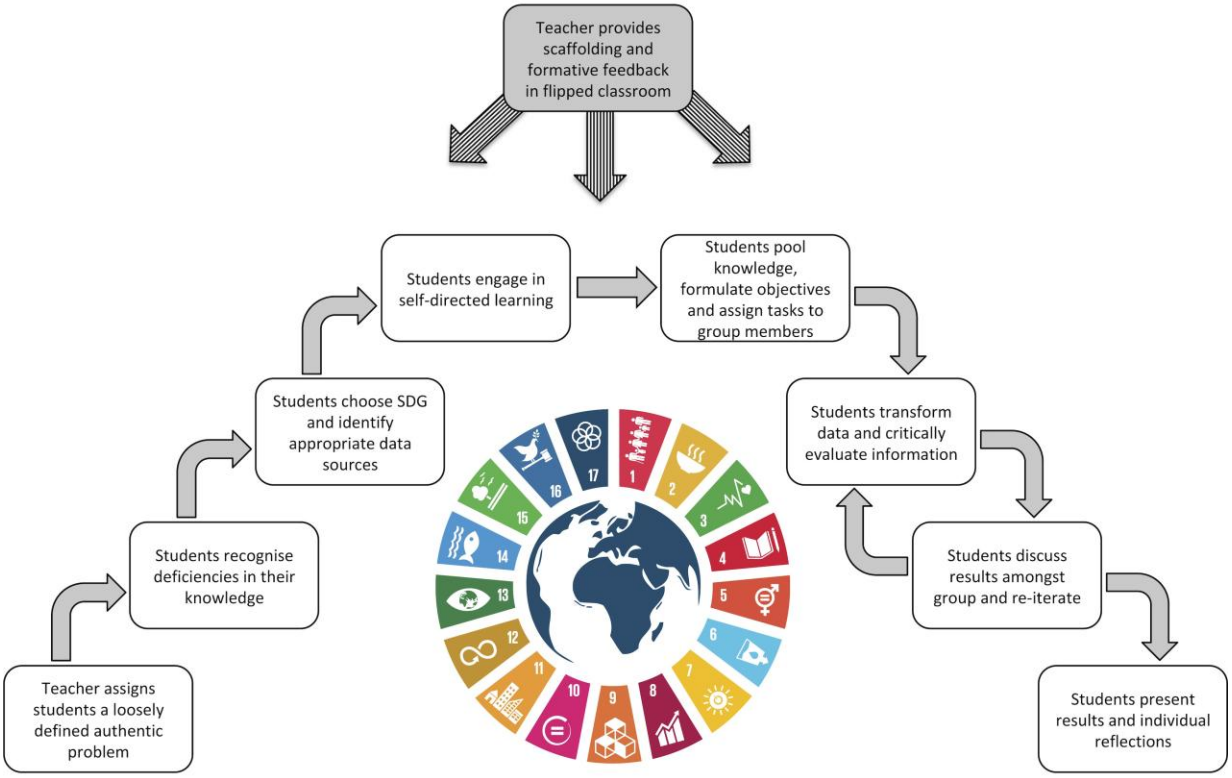
The course had the advantage of being examined entirely by continuous assessment, which afforded the teacher a degree of latitude and facilitated the 'bedding in' of this new approach.

Participants

A total of 65 students enrolled upon the course (29 in Semester 1; 36 in Semester 2), of which 33.8% were females and 66.2% were males. The class included students of 13 different nationalities: Bangladesh, Belgium, Bulgaria, Hungary, Ireland, Malaysia, Nigeria, Pakistan, Poland, The Philippines, Saudi Arabia, USA, and Zimbabwe. The students were provided with a loosely defined assignment specification (see Appendix 1) which required them to critically analyse data pertaining to the SDGs. Working in teams of four or five, they selected a SDG of personal interest to them, identified relevant indicators, judiciously gathered polymorphic data from a variety of sources to address their chosen indicators, modelled the data, and used it to build a database on the MongoDB cloud-based platform. The course adopted a flipped learning model, where students were assigned e-learning materials to review prior to each week's scheduled class (see Figure 2) and given significant autonomy and responsibility for their own learning.

Figure 2

Purpose-based learning in a flipped classroom environment



Design

Using a systematic AI prompting methodology developed by the teacher, students employed ChatGPT to write Python scripts to cleanse and transform the data in the first instance, and then to generate database reports based on carefully articulated natural language specifications. They imported the MongoDB database output into a visual analysis tool (Tableau) and created interactive information dashboards to generate meaningful insights. Finally, they prepared a comprehensive report to document findings and reflect on their experiences of working with SDG data, which is known to be problematic (Jütting & McDonnell, 2017; MacFeely, 2017).

With the flipped learning approach, scheduled class time was primarily devoted to the teacher providing continuous formative feedback and guidance on students' work-in-progress. Prior to enrolling on the course, the students had no prior knowledge of the technologies they were using, but with the help of the AI prompting methodology developed by the teacher, they quickly learned how to manipulate and interrogate the data. Students were also required to independently research the SDGs and indicators that they selected, so that they could produce a contextually informed analysis of the data.

After submitting their assignment, students were invited to participate in a survey about their experiences. The survey included 15 questions, mostly employing 5-point Likert-scale items adapted from previous instruments (Honey, 2005; OECD, 2018; Wang et al., 2023; Ng et al., 2024; Wolff et al., 2016; Pothie & Condon, 2020), along with demographic information. To ensure students were genuinely engaged and not simply satisficing, the questionnaire included dummy items (e.g., "I dress up as Angelina Jolie and gate-crash a UN summit (Click Never)"). Responses that failed to follow the instructions for these dummy items were deemed invalid and removed. Additional qualitative data were collected from students' group assignment reports, end-of-course individual reflections, and the university's independent student feedback reports.

Analysis

The qualitative data from student reflections were analysed using the grounded theory approach developed by Strauss and Corbin (1990). The coding process involved three stages: open coding to identify initial concepts, axial coding to explore relationships between categories, and selective coding to integrate and refine themes. This iterative process continued until thematic saturation was reached, indicated by the absence of new themes in subsequent analyses. Coding was performed by the author, supplemented by regular peer debriefing sessions to promote consistency and reduce subjective bias. Although formal intercoder reliability statistics were not calculated, these methodological steps contributed to the trustworthiness of the findings. Future research may benefit from incorporating multiple coders and formal reliability checks to enhance methodological robustness. All the required stages of approval were obtained from the University of Galway Ethics Committee before commencing the study. The invitation to participate in the survey was issued after the conclusion of teaching. Data were anonymised so that it was not possible to identify any individual respondent.

Results

Most groups based their projects on either SDG3 (Good Health and Wellbeing) or SDG8 (Decent Work and Economic Growth). However, across the sixteen projects submitted, nine of

the 17 SDGs were addressed. A total of 65 individual reflections were received and the survey achieved a response rate of 49.2%, yielding 29 valid submissions after excluding three that failed the dummy items.

Survey respondents represented diverse nationalities, with some holding dual citizenship. Among them, 25% were monolingual, 46.9% bilingual, and 28.1% multilingual. All participants were fluent in English; additional languages spoken included Bengali, Dutch, French, German, Hindi, Hungarian, Irish, Italian, Spanish, Urdu, Yoruba, and Zulu. The gender distribution of valid respondents was 44.8% female and 55.2% male.

The predominance of SDG 3 and SDG 8 among student projects is noteworthy. These goals may resonate strongly with business students due to their alignment with professional trajectories in health tech, fintech, and employment-related data systems. Furthermore, several groups expressed personal and cultural connections to issues like inequality, corruption, gender inequality or educational access, suggesting that students' sociocultural backgrounds informed their selection of SDGs. This supports the PDL principle of aligning learning tasks with learners' values and lived experiences (Moreno, 2022) and exemplifies the link between personal relevance and global competence (Gregersen-Hermans, 2021).

Authenticity, Motivation and Learning Experience

The students readily embraced the new purpose-driven approach adopted on this course in the 2023/24 academic year. For their projects, they selected SDGs and indicators that were of deep personal interest to them. In particular, a number of groups zoned in on issues to do with gender inequalities in health, education and employment. Some examples of students' motivations are:

> "The UN Sustainable Development Goal that we decided to base our project on is 'Zero Hunger'. The reason we chose this SDG is because we all agree that it is extremely shocking that, in a world that has never been so wealthy, so many people still suffer from undernourishment." (Group 1)

> "We decided to focus on SDG 16. Our motivation behind this choice was that this goal emphasises the importance of effective, transparent, and accountable governance at all levels. Good governance is fundamental for creating an enabling environment for development, and combating corruption, which can undermine social progress and economic prosperity." (Group 3)

> "We wanted to measure the growth of the BRICS countries, as they are comprised of some of the fastest growing economies in the world. We were intrigued by their alliance and wanted to analyse each country's economic history from 2005 to 2015 to assess their past performance and to give an indication of where they are heading in the context of SDG8." (Group 6)

> "For this assignment we decided to select SDG4, which aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. We chose this as we believe it to be imperative for creating a sustainable and equitable future. Education is paramount for societal development and breaking the cycle of poverty." (Group 9)

These sample statements illustrate how students were motivated to engage with PDL by connecting their practical data analytics education to meaningful, outcome-oriented, knowledge-generating tasks. They indicate an engagement with systems thinking and ethical considerations – skills that are tied to both global competence (Gregersen-Hermans, 2021) and critical AI literacy (Hornberger et al., 2023). Students developed global competence by situating their projects within the context of universal challenges, enhancing their understanding of interconnected global issues. Their motivations clearly show an alignment between their academic goals and purposeful real-world applications that span cultural, economic, and systemic boundaries, consistent with authentic learning theory (Lombardi, 2007).

The work produced by students in the 2023/24 iteration of the course was of higher quality than previous years. The examiner's report noted: "*Superb standard of performance in this module this year. Assignment on UN SDGs was of really high calibre*." This improvement can largely be attributed to students' heightened motivation and interest in the project, driven by a sense of meaningfulness and authenticity in their work, as exemplified by the following excerpts from their personal reflections:

> "One of the most significant takeaways we had from this assignment was the realisation of the positive impact that technology, like NoSQL databases, can have on societies. In this assignment we didn't just stick to theory; we took it a step further by applying our knowledge in real-life situations, highlighting the importance of critical thinking, innovation, and collaboration." (Student 6)

> "Our choice to focus on Zero Hunger Sustainable Development Goal was both challenging and enlightening. The datasets, sourced from the UN, provided us with a rich tapestry of information that revealed insights into global hunger and its various facets. We found this assignment very intriguing, as it was quite different in its emphasis from others we had previously done." (Student 11)

> "This assignment has been a valuable experience where we have learned the fundamentals of NoSQL technologies for data processing. We've learned HOW to formulate queries using a variety of operators and resources, but more importantly, we learned the importance of WHY we need to be able to query and mine data. This assignment has shown us the insights and information you can get from data. Such insights are enormously important to contribute towards sculpting the future of the world we live in." (Student 29)

These comments directly support PDL's emphasis on relevance and authenticity, highlighting how learners perceive the practical impact of their work beyond academic settings (Chakraborty et al., 2021). The students clearly grasped the importance of moving from technical proficiency to purpose-driven application, which is an essential aspect of integrating the CDL and PDL frameworks. As shown in Table 1 – which is based on items adapted from Ravenscroft et al. (2017) and Walder (2017) – students largely agreed that the assignment effectively simulated a real-world task and helped them envision how they might perform in their future careers.

Table 1

Authenticity of the Assignment

The assignment ...	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Simulated a real-world task	-	-	10.3%	41.4%	48.3%
Brought authenticity to my learning	-	3.4%	17.2%	44.8%	34.5%
Helped me imagine how I might act in professional practice	-	6.9%	17.2%	27.6%	48.3%
Helped me think about my future career and life journey	-	-	10.3%	34.5%	55.2%

Cronbach's Alpha (4 items) = 0.753

The exercise received overwhelmingly positive feedback from students. 96.6% agreed or strongly agreed that it constituted a valuable learning experience for them, and all indicated that it was enjoyable (see Table 2). All respondents also endorsed the statement: "On this course, I was required to engage in active learning through critical thinking, discussion, investigation, and creation." Furthermore, 96.5% of participants affirmed that the course encouraged them to take responsibility for their own learning (see Table 3).

Table 2

Learning Experience

Opinions about the assignment …	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
It was a valuable learning experience for me	-	3.4%	-	27.6%	69.0%
The form of assessment helped me to gain and retain knowledge more effectively than an essay or written test	-	-	13.8%	37.9%	48.3%
I enjoyed participating in the assignment	-	-	-	34.5%	65.5%
The assignment was an innovative teaching approach	3.4%	13.8%	27.6%	27.6%	27.6%

Cronbach's Alpha (4 items) = 0.734

Table 3

Active Learning

Opinions about the assignment …	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
This course allowed me to take responsibility for my own learning	-	-	3.4%	44.8%	51.7%
On this course, I had to participate in active learning by thinking, discussing, investigating, and creating	-	-	-	17.9%	82.1%

The flipped learning approach and personalised mentoring were key to the success of this course. It was notable that in the independent student feedback survey (which is centrally administered so as to safeguard the anonymity and integrity of responses), 57.9% of students indicated that they found the course "Fairly Difficult" and 21.1% indicated that they found it "Difficult". This was not surprising, for not alone did students have to grapple with technical data analytics issues, they also had to think critically about data, AI and SDGs. However, 16.8% agreed and 79.0% strongly agreed with the statement that "The teaching staff were patient in explaining difficult concepts and topics", and the entire class agreed or strongly agreed that "I received feedback on my performance to help improve my learning." When asked, "What did you like about this module?", comments included:

> "Lecturer was more than happy to meet with students to provide feedback, interesting lectures." (Anon)
>
> "I find it interesting and I really appreciate how helpful and enthusiastic <lecturer name> is and how willing he is to give feedback and help us with assignments." (Anon)
>
> "<lecturer name>, great teaching and fun subjects, especially how we are expected to use AI tools to help us." (Anon)

When prompted, "What suggestions can you offer to improve this module in the future?", the majority of students expressed satisfaction with how the course had been conducted. However, not surprisingly, some commented that they would have preferred "clearer explanations of requirements," "easier content," or "more supporting materials." This highlights the delicate balance that a teacher using PDL and flipped learning must strike: providing enough scaffolded support and structure to help students navigate independently, without over-guiding them along the path, while also being careful not to leave them floundering aimlessly.

The findings therefore support Hypotheses 1, 2 and 3 because the experiences of this study were that PDL was indeed regarded as being highly authentic and relevant, all students expressed a high level of interest and motivation, and the overall learning experiences were reported as generally very positive.

Global Competence

62.1% of students had no or very little knowledge about their chosen SDG prior to this assignment. However, 93.1% professed to know quite a lot or be highly informed afterwards. This is a clear measure of its effectiveness in improving global competence. Furthermore, 82.8% of students agreed or strongly agreed that the assignment helped them develop the ability to work towards addressing business, policy and societal problems within a global context, 75.8% agreed or strongly agreed that it increased their knowledge and awareness of sustainability, and 96.6% felt that it educated them to make more ethical, socially responsible decisions in a business context.

As previously mentioned, the University of Galway has demonstrated a strong commitment to advancing the UN Sustainability Development Goals. This is highly visible to students, as signs and banners promoting various aspects of the sustainability agenda and emphasising the importance of collective effort to achieve progress are prominently displayed across the campus. As one student remarked:

> "The fact that the University of Galway is a national SDG Champion for 2023-2024 underscores the profound significance of this project to us. As a SDG Champion, the University acts as an advocate and promoter of the SDG goals, encouraging organisations to embrace and implement vital changes towards these targets. This role resonated deeply with us as we delved into the SDGs outlined by the UN, providing us with invaluable insights." (Student 17)

Several students noted that the purpose-driven data analytics assignment enhanced their understanding of global issues and strengthened their ability to collaboratively analyse and address challenges:

> "The purpose of this assignment guided our group in accomplishing several key objectives. First and foremost, it encouraged us to contribute towards resolving challenges spanning the realms of business, policy, and society, all within a global framework. Our group gained meaningful insights into economic development which was emphasised by Goal 8. This goal stressed the importance of sustained economic growth as a driver of poverty reduction and overall well-being in the countries we selected." (Student 23)

> "One of the primary objectives of this assignment was to contribute to addressing real-world challenges within a global context. By delving into the complexities of economic growth, employment, and fair labour, we've not only learned about these issues but actively engaged in finding ways to contribute solutions." (Student 4)

The above sample comments align with the development of global competence as outlined by Li (2013) and Simpson & Dervin (2019), especially in how learners connect local skillsets to international problem-solving. They also reflect a shift toward purposeful learning where students make meaningful connections between academic content and global societal needs, which is a hallmark of PDL.

Reassuringly, it was clear that students grasped the purpose of the exercise, as had been explained to them during the course's introductory session. They understood that their goal was not merely to master the basic mechanics of using data analytics tools or to produce summary

reports for their own sake. Instead, they recognised a larger objective, which was to creatively apply their technical and critical thinking skills to meaningfully address real-world issues:

> "For our assignment, we created 30 complex queries, and 5 advanced queries, each addressing and critically analysing SDG 3. Example queries from our assignment are 'Comparing death rates compared to the standard of living between countries,' and 'The top type of Non-Communicable Diseases that kill the most people each year.' We focused on providing quality queries, giving in depth reasoning and explanation behind each one, making them as useful and informative as possible." (Student 8)

> "Simply gathering data isn't enough, the true value comes from understanding the significance of this data and knowing what to do with it. The ultimate objective is to transform it into information and actionable insights that inform decision-making and drive positive societal change. During the assignment, my group used the data we collected to identify patterns and trends, examining differences between different time periods to gauge economic progress. For instance, when exploring a decline in crime rates, we didn't stop at the surface-level observation. Instead, we examined the policies in effect at the time, shifts in law enforcement strategies, and societal dynamics. Understanding the context helped us figure out why things happened the way they did and find ways to repeat or do even better in the future." (Student 15)

> "For our assignment we began by gathering the necessary data and selecting our five indicators which each shed light on a different aspect of the state of education in developing countries. Throughout the course of completing the assignment and analysing the data, we gained insights into the sheer disparity between our world and the realities faced by those in developing countries. Many countries showcased alarming deficiencies in basic amenities that we would take for granted, with numerous countries having more schools without running water or qualified teachers than with, and others with alarmingly low education rates. Analysis such as this is crucial for identifying areas in which intervention and assistance is needed." (Student 3)

Table 4, which is based on a scale from OECD (2018), reflects students' levels of global mindedness after completing the assignment. Because no comparative data was captured beforehand, it would be a leap too far to surmise that the assignment is the sole cause of the high levels of global mindedness seen here. However, other evidence suggests that it played a significant role in raising students' awareness of global issues. Notably, in response to a question in a different section, 93.1% of students agreed with the statement: "The UN SDG assignment inspired me to become more actively involved with societal initiatives."

Overall, there is sufficient evidence to support Hypothesis 4, which posits that purpose-driven learning linked to the SDGs fosters a strong sense of global-mindedness.

Table 4

Global Mindedness

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I think of myself as a citizen of the world	-	-	6.9%	37.9%	55.2%
When I see the poor conditions that some people in the world live under, I feel a responsibility to do something about it	-	-	27.6%	48.3%	24.1%
I think my behaviour can impact people in other countries	-	3.4%	27.6%	37.9%	31.0%
It is right to boycott companies that are known to provide poor workplace conditions for their employees	-	6.9%	10.3%	44.8%	37.9%
I can do something about the problems of the world	3.4%	6.9%	34.5%	37.9%	17.2%
Looking after the global environment is important to me	-	3.4%	17.2%	48.3%	31.0%

Cronbach's Alpha (6 items) = 0.827

Critical Data Literacy and AI Literacy

All groups encountered hurdles as regards data quality, technical issues, and the learning curve for using analytics tools. However, these difficulties contributed significantly to their knowledge and skill development, particularly in critical thinking and problem-solving. Some indicative remarks are:

> "The challenges we encountered, especially with data sourcing and consistency, tested our problem-solving skills. It compelled us to think critically and adapt our strategies, emphasising the importance of flexibility in data analysis." (Group 19)

> "We divided the work so that each team member had the opportunity to work on different slices of the data across multiple stages of the project. This process required critical thinking and innovative problem-solving, as we had to ensure that our queries were meaningful in the context of a specific SDG indicator and that we worked individually and collectively in a way that was cohesive." (Group 6)

These remarks demonstrate critical data literacy in action, as students moves from basic coding to contextual, value-oriented data interpretation.

Table 5

Critical Thinking

Which of these typifies your way of doing things ...	Never	Rarely	Sometimes	Often	Always
I double-check facts for accuracy	-	-	17.2%	65.5%	17.2%
I play devil's advocate in order to improve my grasp of an argument or proposition	3.4%	20.7%	34.5%	37.9%	3.4%
I test the assumptions underpinning an argument or proposition	-	10.3%	41.4%	44.8%	3.4%
I explore statements for ambiguity to ensure I do not misconstrue their meaning	-	17.2%	17.2%	55.2%	10.3%
I draw conclusions from data I have analysed in order to decide whether to accept or reject a proposition or argument	-	6.9%	13.8%	58.6%	20.7%
I look for what isn't there rather than concentrate solely on what is there	6.9%	17.2%	34.5%	37.9%	3.4%
I consider new information to see whether I need to re-evaluate a previous conclusion	3.4%	3.4%	20.7%	55.2%	17.2%
I ask questions to reinforce my understanding of the issue	-	3.4%	13.8%	34.5%	48.3%

Cronbach's Alpha (8 items) = 0.705

Overall, 89.6% of survey respondents felt that the assignment helped develop their critical thinking skills. Table 5 presents responses to selected items derived from Honey's (2005) comprehensive questionnaire on critical thinking (CT). Table 6 highlights the extent to which students perceived the assignment as contributing to the development of their critical data literacy (CDL) capacity, based on items adapted from previous instruments (Wolff et al., 2016; Maybee & Zilinski, 2015; Kjelvik & Schultheis, 2019; Pothie & Condon, 2020). Table 7 illustrates how it enhanced students' critical artificial intelligence literacy (CAIL), using measures developed by Wang et al. (2023) and Ng et al. (2024). While the students' overall scores for CT showed some room for improvement, it is clearly evident that the assignment contributed substantially to enhancing their CDL and CAIL skills, in support of Hypotheses 5 and 6.

Table 6

Critical Data Literacy

The assignment helped develop my ability to ...	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Locate and select appropriate data sources	-	-	-	37.9%	62.1%
Assess the quality, credibility, and trustworthiness of data available in the public domain	-	-	13.8%	37.9%	48.3%
Cleanse and transform “messy” data	-	-	6.9%	37.9%	55.2%
Analyse, organise, synthesise and interpret data	-	-	6.9%	37.9%	55.2%
Present meaningful visual representations of data	-	-	3.4%	34.5%	62.1%
Provide a clear and coherent story about the data *	3.4%	3.4%	41.4%	48.3%	3.4%
Compare and contrast insights derived from complementary data sets from different sources	-	3.4%	10.3%	37.9%	48.3%
Make decisions and recommendations based on analysis of data	-	-	13.8%	34.5%	51.7%
Make critical judgments about the reliability of information presented in the public domain	-	-	17.2%	34.5%	48.3%

* This item was removed after executing scale reliability tests. The consequent value for Cronbach’s Alpha (8 items) was 0.915.

Composite scores were calculated for all scales after removing items that reduced internal consistency. Cronbach’s Alpha for CT was marginally acceptable at .705, while CDL and CAIL demonstrated excellent reliability with values of .919 and .905, respectively. Spearman’s rank-order correlations were conducted to assess the relationships between CDL, CAIL and CT. The results, shown in Table 8, are particularly interesting. A strong, positive correlation was revealed between CDL and CAIL (ρ=.711, p< .001, N=28), indicating that higher levels of CDL are associated with higher levels of CAIL. This clearly supports Hypothesis 7.

Table 7

Critical AI Literacy

The assignment helped develop my ability to ...	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Use AI technologies to improve my work efficiency	-	3.4%	3.4%	13.8%	79.3%
Evaluate the capabilities and limitations of an AI application	-	3.4%	-	24.1%	72.4%
Use AI to achieve common good and serve others	-	-	6.9%	24.1%	69.0%
Apply AI technologies to solve problems	-	-	6.9%	17.2%	75.9%
Assess the correctness of a solution suggested by AI *	-	-	3.4%	34.5%	62.1%
Use AI to augment my programming and coding skills	-	-	17.2%	31.0%	51.7%

* This item was removed after executing scale reliability tests. The consequent value for Cronbach's Alpha (5 items) was 0.909.

A moderate, positive correlation was found between CAIL and CT (ρ=.501, p=.006, N=29), indicating that higher levels of CAIL are moderately associated with higher levels of CT. In contrast, the correlation between CDL and CT was not statistically significant (ρ=.355, p>.05, N=28), suggesting no meaningful association between these variables in this sample.

Table 8

Intercorrelations Among Constructs

Variable	1	2	3	4	5	6
1. Critical Data Literacy (CDL)	-					
2. Critical AI Literacy (CAIL)	0.711 *** (28)	-				
3. Authenticity	0.616 *** (28)	0.554 ** (29)	-			
4. Learning Experience	0.601 *** (28)	0.386 * (29)	0.613 *** (29)	-		
5. Global Mindedness	0.449 * (28)	0.515 ** (29)	0.538 ** (29)	0.586 *** (29)	-	
6. Critical Thinking (CT)	0.355 (28)	0.501 ** (29)	0.302 (29)	0.329 (29)	0.503 ** (29)	-

Note. Correlations are Spearman's *ρ*. The sample size (*N*) for each correlation is provided in parentheses. *N* values vary due to missing data. * $p < .05$, ** $p < .01$, *** $p < .001$.

Analysis of students' reflections indicated deep engagement with CDL concepts, including data preparation and transformation for usability, the accuracy, reliability, and relevance of data,

identifying and addressing data gaps and inconsistencies, and understanding the broader implications of data limitations on analysis and decision-making:

> "We were overwhelmed with the amount of data there is available, but most of it had not been transformed and was not in an easily digestible format." (Student 19)

> "Our experience on this project made it clear to us how important it is to have reliable and accurate data. We faced difficulties with the availability of data that was correct, relevant and dependable. We now know that any data analysis project's capacity to succeed depends on the level of accuracy and suitability of the available data." (Student 27)

> "For most of this assignment, we didn't meet any difficulties with data sources. However, it did happen that some databases we wanted to work on were almost empty. For instance, data sets had observations for only specific years for some regions, while other regions had observations for a completely different time, which made it impossible to analyse the database correctly." (Student 2)

> "In the context of indicator SDG 8.5.2, which is related to unemployment rate by sex, age, and disabilities, we found there were numerous countries where there was no data or limited data available. These gaps in the datasets mean that the insights derived from our analysis may not be entirely accurate, potentially affecting decision-making for governments striving to meet their targets. Furthermore, such inaccuracies not only affect the decision-making process but also make cross-country comparisons challenging, potentially hindering the evaluation of goal effectiveness." (Student 16)

Awareness of the transformative power of data visualisations to raise public awareness of SDGs and influence policy-making also came through very strongly in students' reflections:

> "Through this assignment we also learned how to take our raw data and create clear and engaging visual representations of it while using Tableau. We learned the importance of these visualisations as they make the data way more accessible, attractive and valuable to someone who has no prior experience with data." (Student 5)

> "The data must be presented in a way that all can understand in a global context. It needs to have a purpose, to tell a story about how each SDG is coming along and if it is on track or needs to be highlighted. It needs to be abundantly clear to all what stage the target has at, as well as concise. The data needs to be visualised so everyone has an immediate understanding of how the goal has been monitored." (Student 9)

> "I believe that by transforming these datasets for the purpose of the 2030 SDG Agenda, it will open the eyes of the public. Using software like Tableau and MongoDB, they can utilise this information into visual forms to highlight the severity for global issues." (Student 23)

Additionally, several reflections highlighted how the assignment enhanced CAIL capabilities. Students demonstrated an ability to leverage tools like ChatGPT for efficiency while critically evaluating its outputs and limitations. They also acknowledged the importance of learning from errors, integrating AI assistance with their own problem-solving and critical thinking skills. Additionally, students emphasised the need for a strong understanding of the underlying data

and objectives, recognising that human oversight is essential to ensure the accuracy and alignment of AI-generated outputs with project goals.

> "We found ChatGPT to be a useful tool. We used it for assistance in generating our MongoDB queries, it saved us a significant amount of time that we used for other parts of the assignment. At the outset, we found it very difficult to understand the semantics of the queries. However once we turned to ChatGPT for guidance, our task became much easier. Having constructed some basic queries, we could then further question ChatGPT as to why it was generating code in a certain way. After some practice, we were able to prompt it to generate specific pieces of code that we were confident we could execute." (Group 16)

> "We worked quicker as we became more proficient in the software we were using. We learned to leverage AI tools such as ChatGPT to speed up our work alongside our processes accelerating as we got used to the handling and procurement of data." (Group 23)

> "We found that a lot of our learning came from trial and error. While this method can be frustrating, ultimately, it made us grow and develop skills such as critical thinking and innovative problem-solving. When queries outputted unexpected results, we had to identify what was wrong and address the issue. Although ChatGPT proved to be a valuable tool, it had its shortcomings, such as occasional errors in code generation or misunderstanding our prompts. These experiences made us realise that, while ChatGPT is a valuable resource, it should not be solely relied upon." (Group 8)

> "In undertaking our project, several crucial learnings emerged, notably regarding the importance of meticulous attention to details with AI-generated code. Without comprehensive knowledge of the source data, AI-generated queries were likely to produce erroneous results and/or fail to address the intended objectives." (Group 12)

These reflection shows students grappling with the limitations of AI, a key element of developing critical AI literacy (Wang et al., 2023). Overall, the collective quantitative and qualitative evidence upholds Hypotheses 5, 6 and 7.

Conclusion

Purpose-driven learning (PDL) emphasises integrating real-world challenges, such as the SDGs, into education to help students develop a deeper understanding of major societal issues. It encourages them to critically reflect on their own purpose and mission as they prepare to become innovative, transformative leaders. By orienting learning around students' values, passions, and life goals, PDL fosters intrinsic motivation and creates more meaningful and impactful experiences for students, preparing them for a fulfilling life beyond the classroom.

The growing interest in PDL reflects a broader shift in education toward personalised, student-centred approaches that prioritise preparation for real-world complexities over examinations. However, implementing PDL in traditional systems can be challenging. It demands flexible structures, personalised learning plans, and teacher training to shift educators' roles from knowledge providers to mentors guiding students in aligning their learning with personal and social goals.

As was discovered in this study, PDL is particularly powerful when combined with critical data literacy (CDL) and critical artificial intelligence literacy (CAIL), which are intrinsically linked. While CDL/CAIL provides students with the technical skills and critical thinking necessary to analyse data and AI technologies, PDL provides the broader context and motivation for applying these skills ethically and effectively to solve real-world problems. Without a purpose, CDL/CAIL would remain a purely technical exercise; when paired with PDL, it becomes a transformative tool for driving social change, addressing global challenges, and informing policy. CDL/CAIL equips students with the "how," while PDL provides the "why," connecting data-driven work to tangible societal outcomes.

The course exercise discussed in this paper illustrates the potential of PDL to inspire students and build global competencies through addressing real-world challenges. The integration of PDL with a focus on SDGs, a flipped learning approach, continuous assessment and small classes helped create an engaging educational experience that students greatly enjoyed, as reflected in the outstanding technical quality and thoughtfulness of their work. Through purposeful implementation and alignment with institutional research themes, PDL demonstrated promise in shaping engaged, globally-minded learners equipped with the knowledge, skills and motivation to make meaningful contributions to society in future.

Based on the outcomes of this study, plans are underway to revise the programme to embed more purpose-driven components across other modules, particularly those focused on ethics, project management, and systems thinking. Given the cross-cutting nature of the SDGs, the approach demonstrated here has significant potential to be adopted in interdisciplinary educational contexts. Collaborations are currently being considered with other departments to explore shared modules or joint projects that enable students to tackle global challenges through multiple disciplinary lenses. Such interdisciplinary integration would not only enhance students' global competence but also foster a more holistic understanding of complex societal problems. The findings of this study cannot be broadly generalised. However, the approach demonstrates clear potential for replication in data analytics courses or cognate disciplines.

While this study offers valuable insights into the integration of purpose-driven learning with data analytics education, several limitations should be acknowledged. First, the findings are based on a single institutional context and a relatively small, self-selecting sample, which limits the generalisability of the results to broader populations or disciplines. Second, the study employed a cross-sectional design without pre- and post-intervention measures, which constrains the ability to assess changes over time or draw causal inferences. Third, much of the data collected – particularly survey responses and reflections – relied on student self-reporting, which is subject to social desirability and recall bias. Although triangulated with assignment outputs and feedback data, these limitations suggest that findings should be interpreted with caution. Future research could build on this work by employing longitudinal designs, incorporating objective performance metrics, and replicating the intervention in different institutional or disciplinary settings. Additional details about the assignment specification (beyond what is included in Appendix 1) and the survey instrument are available upon request from the author.

Declaration

The author discloses that he has no actual or perceived conflicts of interest. Funding for this study was obtained from the University of Galway and the UKI PRME Research Seed Funding scheme. The author made some use of artificial intelligence in the production of this paper, but only to suggest enhancements to legibility. CRediT contributions are: the author was solely involved in writing-up this work and for managing all aspects of the project.

References

Beatty, J. F., Hill, P. L., & Spengler, M. (2025). Sense of purpose and social-emotional-behavioral skills during university. *Personality and Individual Differences, 233*, 112870. https://doi.org/10.1016/j.paid.2024.112870

Camargo, E. (2016). *Envisioning Virginia Tech: Beyond boundaries, preparing students for the world in which they will live and work.* https://vtechworks.lib.vt.edu/server/api/core/bitstreams/c4135ab5-d9fa-426d-be55-90b7b899ccc2/content

Chakraborty, A., Kumar, S., Shashidhara, L. S., & Taneja, A. (2021). Building sustainable societies through purpose-driven universities: a case study from Ashoka university (India). *Sustainability*,*13*(13), 7423. https://doi.org/10.3390/su13137423

Cross, I. D., & Congreve, A. (2021). Teaching (super) wicked problems: authentic learning about climate change. *Journal of Geography in Higher Education, 45*(4), 491–516. https://doi.org/10.1080/03098265.2020.1849066

Cui, Y., Chen, F., Lutsyk, A., Leighton, J. P., & Cutumisu, M. (2023). Data literacy assessments: A systematic literature review. *Assessment in Education: Principles, Policy & Practice, 30*(1), 76–96. https://doi.org/10.1080/0969594X.2023.2182737

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum.

Fletcher, C., Ripple, W. J., Newsome, T., Barnard, P., Beamer, K., Behl, A., Bowen, J., Cooney, M., Crist, E., Field, C., Hiser, K., Karl, D. M., King, D. A., Mann, M. E., McGregor, D. P., Mora, C., Oreskes, N., & Wilson, M. (2024). Earth at risk: An urgent call to end the age of destruction and forge a just and sustainable future. *PNAS Nexus, 3*(4), pgae106. https://doi.org/10.1093/pnasnexus/pgae106

García Serna, E., Yépez González, E., & Calderón Ávila, Y. (2024). Education with purpose: Student empowerment, an international perspective / Educación con propósito: Empoderamiento estudiantil, una perspectiva internacional. *LATAM Revista Latinoamericana De Ciencias Sociales Y Humanidade*s, *5*(4), 1742. https://doi.org/10.56712/latam.v5i4.2371

Gregersen-Hermans, J. (2021). Toward a curriculum for the future: Synthesizing education for sustainable development and internationalization of the curriculum. *Journal of Studies in International Education, 25*(4), 461–481. https://doi.org/10.1177/10283153211031033

Haski-Leventhal, D. (2020). *The Purpose-Driven University: Transforming Lives and Creating Impact through Higher Education*. Emerald Publishing Limited.

Haski-Leventhal, D., Pournader, M., & Leigh, J. S. (2022). Responsible management education as socialization: Business students' values, attitudes and intentions. *Journal of Business Ethics, 176*(1), 17–35.

Hassani, H., Huang, X., MacFeely, S., & Entezarian, M. R. (2021). Big data and the United Nations Sustainable Development Goals (UN SDGs) at a glance. *Big Data and Cognitive Computing*, *5*(3), 28. https://doi.org/10.3390/bdcc5030028

Holkenborg, K. (2024). *On purpose. Design principles for interventions that encourage students' sense of meaning in life in higher education* (Masters dissertation, University of Twente, The Netherlands). https://essay.utwente.nl/99073/1/Holkenborg_MA_BMS.pdf

Honey, P. (2005). *Critical Thinking Questionnaire*. Retrieved February 6, 2011 from http://www.peterhoney.com

Hornberger, M., Bewersdorff, A., & Nerdel, C. (2023). What do university students know about artificial intelligence? Development and validation of an AI literacy test. *Computers and Education: Artificial Intelligence, 5*, 100165. https://doi.org/10.1016/j.caeai.2023.100165

Jütting, J., & McDonnell, I. (2017). Overview: What will it take for data to enable development. In: *Development Co-operation Report 2017*, OECD. https://doi.org/10.1787/dcr-2017-6-en

Kjellgren, B., & Richter, T. (2021). Education for a sustainable future: Strategies for holistic global competence development at engineering institutions. *Sustainability*, *13*(20), 11184. https://doi.org/10.3390/su132011184

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development (Vol. 1)*. Englewood Cliffs, NJ: Prentice-Hall.

Lameras, P., Arnab, S., & Lewis, M. (2023). From data abundance to informed citizenship: The empowering potential of the Dali Life game for data literacy. In *Interactive mobile communication, technologies and learning* (pp. 277–286). Cham: Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-56075-0_26

Laupichler, M. C., Aster, A., & Raupach, T. (2023). Delphi study for the development and preliminary validation of an item set for the assessment of non-experts' AI literacy. *Computers and Education: Artificial Intelligence, 4*, 100126. https://doi.org/10.1016/j.caeai.2023.100126

Lefebvre, H., Legner, C., & Fadler, M. (2021). Data democratization: toward a deeper understanding. In *Proceedings of the International Conference on Information Systems (ICIS)*, Austin, Texas, USA, December 12-15. https://aisel.aisnet.org/icis2021/gen_topics/gen_topics/7

Leong, J. (2014). Purpose-driven learning for library staff. *The Australian Library Journal*, *63*(2), 108–117. https://doi.org/10.1080/00049670.2014.898236

Li, Y. (2013). Cultivating student global competence: A pilot experimental study. Decision Sciences *Journal of Innovative Education, 11*(1), 125–143. https://doi.org/10.1111/j.1540-4609.2012.00371.x

Lindholm, J. (2023). 21st-century leadership practice: Building reflection into sustainable purpose. In L. Irwin, I. Rimanoczy, M. Fritz, & J. Weichert (Eds.), *Transforming business education for a sustainable future: Stories from pioneers* (pp. 202–214). Routledge. https://doi.org/10.4324/9781003457763

Lombardi, M. (2007). Authentic learning for the 21st century: An overview. *ELI Papers and Reports*, January 1. EDUCAUSE Learning Initiative. https://library.educause.edu/resources/2007/1/authentic-learning-for-the-21st-century-an-overview

Louie, J. (2022, September 12–13). Critical data literacy: Creating a more just world with data. Paper presented at *National Academy of Science Workshop on Foundations of Data Science for Students in Grades K–12*. https://tinyurl.com/Louie2022

Luedke, C. L., & Garcia, C. E. (2024). Purpose-Driven Involvement for College Students of Color. *College Student Affairs Journal, 42*(1), 52–66. https://doi.org/10.1353/csj.2024.a933848

MacFeely, S. (2017). Measuring the sustainable development goals: what does it mean for Ireland?. *Administration*, *65*(4), 41–71. https://doi.org/10.1515/admin-2017-0033

Mäntyneva, M. (2022). Curriculum-Supporting Global Competence-Related Learning Based on PISA 2018. In *Handbook of Research on Promoting Global Citizenship Education* (pp. 122–138). IGI Global. https://doi.org/10.4018/978-1-7998-9542-8.ch008

Maybee, C., & Zilinski, L. (2015). Data informed learning: A next phase data literacy framework for higher education. *Proceedings of the Association for Information Science and Technology, 52*(1), 1–4. https://doi.org/10.1002/pra2.2015.1450520100108

Milner IV, H. R. (2014). Culturally relevant, purpose-driven learning & teaching in a middle school social studies classroom. *Multicultural Education*, 21(2), 9–17. https://files.eric.ed.gov/fulltext/EJ1045839.pdf

Moreno, A, (2022). *Purpose-driven learning: Unlocking and empowering our students' innate passion for learning*. Routledge: New York. https://doi.org/10.4324/9781003294634

Naï, K. E. (2014). *Principles for purpose-driven learning: Discover your dream, purpose and potential while in or out of school*. CreateSpace Independent Publishing Platform, ISBN 1497380871.

Narayan, R., Rodriguez, C., Araujo, J., Shaqlaih, A., & Moss, G. (2013). Constructivism – Constructivist learning theory. In B. J. Irby, G. Brown, R. Lara-Alecio, & S. Jackson (Eds.), *The handbook of educational theories* (pp. 169–183). IAP Information Age Publishing. https://psycnet.apa.org/record/2013-11995-015

Ng, D. T. K., Wu, W., Leung, J. K. L., Chiu, T. K. F., & Chu, S. K. W. (2024). Design and validation of the AI literacy questionnaire: The affective, behavioural, cognitive and ethical approach. *British Journal of Educational Technology, 55*(3), 1082–1104. https://doi.org/10.1111/bjet.13411

OECD. (2017). *Development Co-operation Report 2017: Data for Development*. https://doi.org/10.1787/dcr-2017-en

OECD. (2018) *PISA 2018 Global Competence Questionnaire*. https://www.oecd.org/en/about/programmes/pisa.html

Pothier, W. G., & Condon, P. B. (2020). Towards data literacy competencies: Business students, workforce needs, and the role of the librarian. *Journal of Business & Finance Librarianship, 25*(3-4), 123–146. https://doi.org/10.1080/08963568.2019.1680189

Pronovost, P. J., Mathews, S. C., Chute, C. G., & Rosen, A. (2017). Creating a purpose-driven learning and improving health system: the Johns Hopkins Medicine quality and safety experience. *Learning Health Systems*, *1*(1), e10018. https://doi.org/10.1002/LRH2.10018

Ratten, V. (2023). Developing management education scholarship in a post-COVID-19 world for global societal impact [Editorial]. *The International Journal of Management Education, 21*(2), Article 100807. https://doi.org/10.1016/j.ijme.2023.100807

Reeves, T. C., Herrington, J., & Oliver, R. (2002, July 7–10). *Authentic activities and online learning*. Paper presented at the Higher Education Research and Development Society of Australasia (HERDSA) 2002 Quality Conversations, Perth, Western Australia. https://researchportal.murdoch.edu.au/esploro/outputs/991005543775607891

Sander, I. (2024). Critical datafication literacy: a framework for educating about datafication. *Information and Learning Sciences, 125*(3/4), 270–292. https://doi.org/10.1108/ILS-06-2023-0064

Saur-Amaral, I., Aragonez, T., & Filipe, S. (2023). Innovative approaches to teaching and learning. *ICIEMC Proceedings, 4*, 240–249. https://doi.org/10.34624/iciemc.v0i4.32541

Simpson, A., & Dervin, F. (2019). Global and intercultural competences for whom? By whom? For what purpose?: An example from the Asia Society and the OECD. *Compare: A Journal of Comparative and International Education, 49*(4), 672–677. https://doi.org/10.1080/03057925.2019.1586194

Stanford (2019). *Uncharted Territory: A Guide to Reimagining Higher Education. Hasso Plattner Institute of Design at Stanford University*. https://dschool.stanford.edu/news-events/unchartedterritory

Corbin, J., & Strauss, A. (2015). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (4th ed.). London: SAGE Publications.

THE (2024). *Top universities pursuing sustainable development goals in 2024*. Times Higher Education. https://www.timeshighereducation.com/impactrankings

Volkovich, V., Soreanu, P., & Mehler, M. (2004). Purpose-driven e-learning model: a new paradigm. In *Proceedings of 8th Multi-Conference on Systemics, Cybernetics and Informatics,* Orlando, Florida, USA, July 18-21. https://www.iiis.org/CDs/CD2004SCI/PapersPdf/S909SM.pdf

United Nations Development Programme. (2020). *Human development report 2020: The next frontier – Human development and the Anthropocene* (ISBN 978-92-1-126442-5). UNDP. https://hdr.undp.org/system/files/documents/hdr2020.pdf

Wamsler, C. (2020). Education for sustainability: Fostering a more conscious society and transformation towards sustainability. *International Journal of Sustainability in Higher Education, 21*(1), 112–130. https://doi.org/10.1108/IJSHE-04-2019-0152

Wang, B., Rau, P. L. P., & Yuan, T. (2023). Measuring user competence in using artificial intelligence: validity and reliability of artificial intelligence literacy scale. *Behaviour & Information Technology, 42*(9), 1324–1337. https://doi.org/10.1080/0144929X.2022.2072768

Wang, L., & Biswas, R. (2024). China's counterpart philosophy and practice of purpose-driven learning. *Region-Educational Research and Reviews, 6*(8), 80–83. https://en.front-sci.com/index.php/rerr/article/view/2495/2723

Wolff, A., Gooch, D., Montaner, J. J. C., Rashid, U., & Kortuem, G. (2016). Creating an understanding of data literacy for a data-driven society. *The Journal of Community Informatics, 12*(3), 9–26. https://doi.org/10.15353/joci.v12i3.3275

Xu, J. J., & Babaian, T. (2021). Artificial intelligence in business curriculum: The pedagogy and learning outcomes. *The International Journal of Management Education, 19*(3), 100550. https://doi.org/10.1016/j.ijme.2021.100550

Zabaneh, R. (2017). *Purpose-driven education: Social entrepreneurship as a pedagogical tool for student success* (Doctoral dissertation, Creighton University, USA). https://researchworks.creighton.edu/esploro/outputs/991005932647302656

Appendix 1: Assignment Specification

Working in groups of 4 or 5, students are required to do the following:

- Familiarise yourselves with the UN Sustainable Development Goals and select one goal (or no more than two related goals) upon which your assignment will be based. You may select any of the 17 goals that interest you, but it is suggested that students of the School of Business & Economics may wish to focus on SDG 3, 8, 9, 11 or 16, which have been identified as priority areas under the School's Strategic Plan.
- For your selected SDG(s), identify five indicators that you are going to explore in depth. You may choose to use the indicators suggested by the UN or alternatively you may choose to use appropriate proxy data. (See provided links to UN, EU and other data portals).
- For your chosen five indicators, you are required to source data. You may choose to focus on certain regions, countries, or time periods, as determined by your own interests. Data can be obtained from any relevant source. You may combine data from several different sources if you wish.
- Create a MongoDB database and import your data into one or more collections. You may need to cleanse or transform the data. It is permissable to use ChatGPT or other AI tool to generate Python scripts for the purposes of data cleansing and transformation.
- Create 30 MongoDB queries against your data, demonstrating a wide range of operators to perform basic and advanced searches, sorting and filtering, counting, aggregations, insertions, updates and deletions. These queries should be carefully chosen so as to usefully summarise data about your chosen SDG.
- It is permissable to use ChatGPT or other AI tools to help in generating and debugging the queries, but this process must be fully documented.
- Export the results of your queries. Import the data into Tableau and create 3 appropriate visualisations. Publish your visualisations in the Tableau Public Gallery on the internet.
- Prepare a report on your project, summarising your key findings and reflecting on your overall learnings from this exercise.
- Marking scheme:
    - Technical quality 30 points
    - Breadth and depth of knowledge 30 points
    - Evidence of reflective learning 10 points
    - Originality and innovation 10 points
    - Evidence of critical thinking 10 points
    - Clarity of presentation 10 points
    - Total points: 100