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A framework of project-based learning (PBL) pedagogy for graphic design education

ABSTRACT

Design programmes commonly employ project-based learning (PBL) in studio settings, emphasising hands-on learning through real-world projects. However, there are multiple practices in the name of PBL. There is confusion about what is and what is not PBL. Furthermore, real-world or authentic projects are integral to PBL but have no clear interpretations. Many studies inform about the advantages of real-world or authentic projects; however, very few about its integration into teaching and even fewer in graphic design education. This action research proposes a framework for the clarity and application of PBL in a graphic design studio class using a real-world design project. The proposed framework in the study derived from the work by Blumenfeld et al., 1991; Krajcik & Blumenfeld, 2005, shows the implementation of a real-world project for graphic design students—an area where the PBL research is scarce. Applied in a communication design course at an Indian university, the framework imparts structure, clarity, and alignment with curricular requirements. This approach ensures successful course completion with tangible outcomes, enriching students' portfolios. The study serves as a model for employing a comprehensive framework based on PBL, demystifies real-world or authentic projects and demonstrates how they can be tailored for holistic learning in graphic design education.

KEY WORDS
project-based learning (PBL), graphic design, real-world projects, authentic projects, design pedagogy, design education, learning by doing

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Introduction

In India, there is a presence of undergraduate, post-graduate, diploma, and certificate programmes in design education (British Council & India Design Council, 2016). These programmes have manifested in diverse forms, including departments within universities, standalone design schools, and small independent design education ventures (Bothra, 2024). The graphic design and related degree programmes are known by different names, such as the four-year programme in “communication design, visual communication, graphic and communication design, graphic design, visual arts, etc.” (Taneja, 2021a). Communication design has become an umbrella term under which graphic design, publication design, UIUX, moving Images—animation and live-action films, branding, and advertising related inputs are given (Taneja, 2021b).

Graphic design is a practice-based profession; thus, educators and policymakers are always concerned about students' industry readiness upon graduation. 'Learning by doing' is commonplace in design education. Students undergo numerous praxis-based projects to address some existing gaps or problems that need solutions. This helps acquire new knowledge and build on intellectual and skill-based capacities.

The PBL pedagogical model within a studio environment is common in learning design. PBL is an approach that engages students in real-world or authentic projects to foster learning (Jones, 2019).

This project method, initially popularized by William Heard Kilpatrick, has experienced a revival in modern education, particularly under the framework of PBL (Pecore, 2015). Although high-quality resources are readily available, misconceptions about PBL continue to prevail. Therefore, it is essential to take a step back and clearly distinguish what PBL truly entails and what it does not (Wolk, 2022). PBL instruction demands teachers to thoroughly understand its pedagogical approach for effective teaching (Han et al., 2015).

Providing effective materials and models to teachers and decision-makers would support the adoption of PBL effectively (Hasni et al., 2016). Clarity is also required about what truly constitutes a PBL project or a real-world project (Thomas, 2000). The PBL method emphasises employing real-world projects. Learning through real-world projects is critical in design education. However, there is a lot of confusion around what can or cannot be considered a real-world project. The term real-world projects is interpreted in many ways, and working on industry projects[1] is just one of those interpretations. Post-liberalisation, there has been a phenomenal rise in the number of design institutes in India (Bothra, 2019). However, access to industry projects for most of the new institutes is far and few between.

Mathur (2014) points out that education at a premier institute, the National Institute of Design (NID) in India has declined due to this reason. It has been observed that due to the inaccessibility of industry projects, there is a lot of dependence on hypothetical projects[2] in graphic design education. Such projects rarely have actual users, clients, and context; thus, they lack applicability in the real-world. In most cases, the instructors are the only source of feedback and critique. Many times the decisions are based on presumptions and assumptions due to the absence of an actual user or the client. These projects may not go through the complete production cycle, in which case the learning related to project implementation in the real-world is compromised. These projects look pretty in students' portfolios but rarely see the light of day.

This study explores and gives clarity about real-world or authentic projects within PBL to reduce reliance on hypothetical projects in the realm of graphic design education. It offers examples of authentic opportunities, a structured PBL framework for educators, and guidance amid varied PBL practices. Given the limited research on design pedagogy in India and globally, this study seeks to bridge the gap and contribute to theoretical advancements in graphic design.

Scope of the Study

The third-year students enrolled in the Bachelor of Design (BDes), a four-year degree programme, were selected for the study. The cohort of thirty-five students was studying in the Communication Design programme at an Indian university. A PBL framework focused on a real-world learning environment was derived primarily from the work of Blumenfeld et al., 1991 and Krajcik & Blumenfeld, 2005. The framework was applied for five weeks during the Publication Design course offered in the third year. This action research examines the functionality of the proposed framework, demystifying PBL and real-world projects in the context of graphic design education. It aims to help academics engage learners in authentic tasks that simulate workplace experiences.

The idea of the study was based on observations in multiple prior courses with different cohorts that demonstrated the usefulness of generating real-world projects for the learners. The lack of research and examples of PBL in design education, especially graphic design education, and the confusion around real-world or authentic projects under PBL became important catalysts for this research.

What is Project-based Learning?

The literature highlights that PBL is a student-centric approach where learning occurs through projects (Farrow, Kavanagh & Samudra, 2022; Rensburg, 2020; Thomas, 2000). It engages students in real-world, authentic projects (Jones, 2019). The students take charge of their learning, with teachers as facilitators. They engage in inquiry, collaborate with peers, utilise technology to tackle real-world challenges, and thereby cultivate various skills essential for the 21st century (Bell, 2010). The final outcome is a well-designed product/artefact (Krajcik & Blumenfeld, 2014; Sumarni, 2015; Thomas, 2000). Project-based learning places the learner at its centre, providing ample opportunity for deep exploration of relevant subjects.

This method fosters learner autonomy; the learners have a choice in both what knowledge they acquire and how they acquire it. The motivation is high as they develop personally meaningful representations of their acquired knowledge (Grant, 2002; Kwietniewski, 2017).

[1] Industry projects are intended to give real-world experiences to students as a result of collaboration between academic institutions and businesses/organisations. These industry-academic partnerships give opportunities to the students to apply the learned skills and theory into practice before they embark on a professional journey.

[2] According to Collins dictionary, if something is hypothetical, it is based on conjectures rather than an actual situation. In design education, students learn through an assortment of assignments and projects. Oftentimes, the assignments or projects are simulated, contoured with conjectures in the absence of a real client, a real need, and lack the actual implementation of the end product.

Blumenfeld et al. (1991) support the notion that PBL is a holistic instructional approach that immerses students in authentic, real-world tasks. Within this framework, students navigate complex challenges by actively engaging in various activities such as formulating and refining questions, debating concepts, predicting outcomes, devising plans or experiments, gathering and evaluating data, formulating conclusions, sharing insights, asking further questions, and developing meaningful artefacts. 'Projects' require two critical factors—a central query/driving question or problems leading to actions. Based on the central question, the actions taken lead to an array of artefacts or products that come together to form the final product. They further explained that artefacts or end-products serve as tangible representations of the solutions put forth by students, showcasing the evolution of their knowledge. These tangible and explicit outcomes can take the form of models, reports, videotapes, or computer programmes.

This hands-on, research-focused approach involves learners in extended engagement, where they collaboratively create, develop, and test their creations, both within and beyond the classroom setting. It emphasises student-centredness where learners actively engage in planning, designing, and implementing projects in real-world contexts. Collaboration among peers is an important feature while the teacher supports the learning process through scaffolding. The process engages students in a range of activities. The real-world projects help cultivate diverse skills, including communication, presentation, critical thinking, problem-solving creativity, teamwork, research, technical proficiency, and project management (Giri, 2016).

Rooted in constructivist theory, PBL views learning as the construction of new ideas based on prior knowledge (Thu, 2018). Thomas (2000), in his research review on PBL, attempts to understand the identifying markers of PBL and exclude what does not represent this method. Through his study, he investigates, "What must a project have in order to be considered an instance of PBL?" He established five criteria to describe a 'project'. "The five criteria are 'centrality, driving question, constructive investigations, autonomy, and realism". Bell (2010) articulates, "PBL is not a supplementary activity to support learning. It is the basis of the curriculum".

Thomas (2000) stressed, "PBL projects are central, not peripheral to the curriculum", and it must involve constructive investigation by the students. He further stressed that "straightforward service projects such as planting a garden or cleaning a stream bed are projects, but may not be PBL projects".

Projects are not predetermined or controlled by teachers, instead are student-driven and conducted in collaboration where the solutions have the potential to be put into practice. The projects involve real-life challenges with an emphasis on authentic problems or questions.

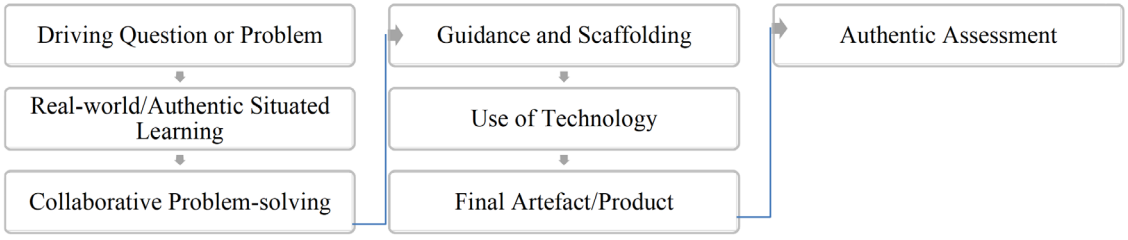
Framework Design

Professor Joseph Krajcik and P.C. Blumenfeld have been doing some noteworthy work in the area of PBL. Some of their well-cited works include, Motivating Project-based Learning: Sustaining the Doing, Supporting the Learning; Enacting Project-based Science; A Collaborative Model for Helping Middle Grade Science Teachers Learn Project-based Instruction; Enquiry in Project-based Science Classrooms: Initial Attempts by Middle School Students. Their book chapter called "Project-based Learning", published in the Cambridge Handbook of the Learning Sciences in 2006, gives a systematic and comprehensive framework.

The framework draws upon some of their previous works and the work of some other authors and propounders of PBL theory, like John Dewey, a well-known educator and philosopher. Krajcik & Blumenfeld (2005) underscore Dewey's belief that students cultivate a genuine interest in the content when engaged in authentic tasks and problems that mirror the practice of professionals in real-world scenarios.

Project-based environments have five essential characteristics (Blumenfeld et al., 1991; Krajcik et al., 1994; S. J. Krajcik & Blumenfeld, 2005; Krajcik & Shin, 2014).

a. A driving question or a problem
b. The driving question leads learners on the path of authentic, situated learning enquiry. In the process of problem-solving, they acquire and apply the core disciplinary knowledge and skills and become proficient performers



» **Figure 1:** *PBL Model Adapted from Blumenfeld et al. (1991); Krajcik & Blumenfeld (2005)*

c. Collaborative problem–solving initiatives and engagement between students, instructors, and community members towards the driving question, emulate complex social situations of expert problem-solving
d. Scaffolding with technology, and learning support facilitates learners to transcend beyond their ability
e. The tangible end-product/products or the artefacts are the manifestations of the process of answering the driving question available publicly as an external representation of the class learning

The seven-point framework of PBL explained in Figure 1 has been further refined by reviewing the related literature.

Understanding the Realm of Real-world/Authentic

Educators in design emphasise learning by engaging the students in authentic tasks to reflect the experience of real-world practitioners. PBL provides real-world experience to learners, thereby helping prepare them optimally for the workplace (Giri, 2016). Theorists too support the idea of exposing learners to authentic experiences—the experience of real-world ways of knowing and doing. Such experiences lead to relevant learning, bringing them closer to praxis (Krajcik & Shin, 2014; Qin, 2022). Boss & Krauss (2014) argue, “at the end of the day, would you rather see your students dumping their ‘work’ into the recycling bin, or talking about an authentic project in which they are driving their own learning?”. They corroborate that the best learning method is via real-world activities, considered most relatable for learners to capture their interest.

The terms "real-world" and "authentic" are often used interchangeably in the literature in the context of PBL. Real-world is described as "the realm of practical or actual experience, as opposed to the abstract, theoretical, or idealised sphere of the classroom, laboratory, etc. (Dictionary.com, 2024). It is also referred to as "the set of situations most humans have to deal with in their lives, rather than what happens in stories and films, etc." (Cambridge Dictionary, 2025). Real-world learning refers to tasks that closely resemble those encountered in the professional spheres involving learning by doing and problem-solving (Krajcik & Shin, 2014).

‘Authentic’ is described as something real, true, accurate and not a copy (Oxford Learner’s Dictionaries, 2025). An authentic learning environment captivates students because the content and context are seen as relevant to their personal needs, while the teacher views them as reflecting real-life situations beyond the classroom (Callison & Lamb, 2015). Larmer (2012) in his article PBL: What does it take for a project to be "authentic"? points out, that *fully authentic* projects are authentic to the lives of learners having a direct impact or use in the real-world. Herrington, Reeves & Oliver (2014) describe authentic learning as a pedagogical approach focusing on practical significance and applicability to real-world contexts. The learning experience is deep and transferable, which is situated in the context of its future applications.

The concept of authenticity is tied to factors such as motivation, participation, and enhanced learning. The authentic problems may reflect challenges faced by professionals, involve real-world processes and tools, create tangible impacts, and address students' interests or concerns (Jones, 2019). Reeves, Herrington & Oliver (2002) conducted a detailed literature review and identified ten key features of authentic activities:

Authentic activities have real-world relevance; are ill-defined, requiring students to define the tasks and sub-tasks needed to complete the activity; comprise complex tasks to be investigated by students over a sustained period; provide the opportunity for students to examine the task from different perspectives, using a variety of resources; provide the opportunity to collaborate; provide the opportunity to reflect; can be integrated and applied across different subject areas and lead beyond domain-specific outcomes; are seamlessly integrated with the assessment; create polished products valuable in their own right rather than as preparation for something else; allow competing solutions and diversity of outcome.

Petraglia (1998) emphasises the significance of understanding what may appear real and meaningful to students rather than aiming for absolute realism. The tasks perceived as real and meaningful by students lead to increased engagement and learning.

In this study, the words authentic and real-world are used to communicate what is real or authentic to the lives of the learners; situated in their immediate context and have a potential for real-world application.

Real-world Project Case

The study is based on the application of a real-world project under the PBL framework. This section gives a brief account of how the project was designed and implemented in the studio setting.

Background Information

Institute of Design, Nirma University offers Communication Design—a four-year degree programme. The thirty-five students who participated in the study had completed two years, of which the first year was the

foundation year[3] that introduced them to various design skills, design concepts, design thinking, and design theory. In year two they had a focused Communication Design engagement. The Publication Design I (course code—DSK 311) course was selected for the study, offered in year three of the programme. The framework began with identifying an authentic design project that aligns with the specifications outlined in the prescribed course syllabus. The literature review suggests that PBL doesn't serve as an ancillary exercise for aiding learning; rather, it forms the foundation of the curriculum. (Bell, 2010; Thomas, 2000; Boss & Krauss, 2014; Jones, 2019). The course syllabus addressed the core fundamentals of graphic design for print publications.

The previous two years of education in the Communication Design programme had equipped students with the prerequisite skills in typography, layout, print production, and design software. The literature review places much emphasis on the long duration of the class for the effective implementation of PBL. This gives learners an opportunity for sustained efforts towards addressing the driving question or problem. The course was assigned 132 hours in the academic calendar with twenty-two teaching days. The course lasted for about a month, including the non-working days. Students did not have any parallel academic engagement during this period.

The course was divided into three phases; the first three weeks were dedicated to Phase 1, and weeks 4 and 5 were dedicated to Phase 2 and Phase 3. The groups decided on multiple intermediate task completion targets with the help of the instructors in view of the end goal. Bell (2010) suggests that PBL is divided into multiple phases for which the timeline must be sacrosanct. Thus, for the smooth flow of various tasks and to conclude the project successfully, it is imperative to chalk out a well-thought-out plan. A detailed course plan, approved university syllabus, an outline of objectives, expected outcomes, and suggested readings were shared with the concerned students before the course commencement.

Application of the Framework

The PBL model was adopted from Blumenfeld et al., 1991 and Krajcik & Blumenfeld, 2005. It consisted of seven major components mentioned in Figure 1 and discussed below.

[3] A foundation year in design education is a preparatory programme to teach the fundamental skills and knowledge related to design principles, techniques, and tools. In India, the first year of the four-year degree programme in design is the foundation year, which is common for all the students interested in studying any specific design specialisation. After the completion of the foundation year, students advance to their chosen specialisations.

Driving Question

Jones (2019) suggests that "teachers select the real-world challenge and should write the overarching problem in the form of a question"; the project was guided by the driving question, "How may we design books that these become a future library resource for students and the academic community?" The driving question was designed keeping to the views of Krajcik, suggesting that a good driving question is *"feasible, worthwhile, contextualised, meaningful* and *ethical"* (Krajcik & Shin, 2014).

Books for print medium were to be designed; however, the exact nature of the books was decided by the students. Blumenfeld et al. (1991) pointed out that students, teachers or curriculum developers can be responsible for creating a driving question or the activities; however, the driving question must not be trivial or the outcomes predefined, leaving no scope for learners to answer the question independently. The instructors ensured that the pre-defined curriculum needs were addressed and students would not feel overwhelmed by the daunting tasks of project work.

The choice of projects, design decisions, project planning & management, goal setting, work distribution, etc. were at the discretion of the students. Scholars over the years have suggested—for students' motivation, they must be given autonomy over the choice of the project, how to carry it forward and the end-products (Blumenfeld et al., 1991; Jones, 2019; Lepper, 1988). Furthermore, teachers take on the role of facilitators or mentors, guiding and overseeing the entire process of learners as they carry out their projects (Thu, 2018).

Project Authenticity and Situated Learning

Blumenfeld et al. (1991) stressed that a learning environment when authentic with real-world context, allowing learners to see the value and meaning of the performed tasks, has a positive impact on the learners. As learners investigate and answer the driving question personally meaningful in their lives and immediate communities, they stand testimony to the application of their work that solved problems of significance.

Furthermore, according to the concept of situated learning, learning occurs in the situation of its intended application and "authentic contexts are the cornerstone of the theory" (Onda, 2012). The research on "situated cognition," suggests that the learning is maximised in situations where the learning context resembles real-life context, allowing the application and utility of the learning outcome. Conversely, learning is minimised in unfamiliar contexts where there is a discord between the learning context and the application of the end-product (Brown, Collins & Duguid, 1995).

The students who wanted to work on a hypothetical design brief[4] were discouraged, as that would have contradicted the framework of a real-world project laid out for the study. The class unanimously decided to collaborate on designing four books in a group setting. The authenticity and utility of the end-products were ensured. The originality of the content was addressed—three books were based on the process and the outcome of the courses completed by the students in previous years and one coffee table book for their university.

Students were encouraged to clearly articulate the design brief, the driving question, and define the purpose of the project and users before moving to the stage of design activity. This stage encompasses learners' involvement in *learning by doing by* following the design process (Ellmers, 2014). This *learning by doing approach* is at the heart of PBL and design education (Taneja, 2022).

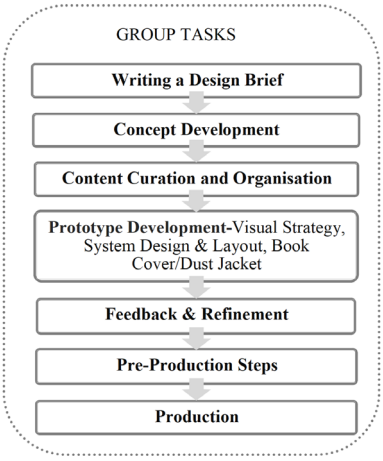
Collaboration

Collaboration is essential for the successful implementation of PBL. Collaborative learning encompasses diverse educational strategies wherein students, or both students and educators, collaboratively engage in intellectual activities (Smith & MacGregor, 1992). When students work in collaboration, they are faced with unavoidable differences, which they learn to acknowledge and tackle. Central components of community life involve developing the ability to accept and resolve differences, create environs to respect different voices and care for others (Smith & MacGregor, 1992). The instructors divided the class into four groups. The group size was determined by the workload associated with the projects. Paredes, Ortigosa & Rodríguez (2010) stressed that "heterogeneous groups tend to perform better than groups formed by students with similar characteristics". Bell (2010) emphasises, "In the real world, people use their individual strengths and talents in their jobs". Thus, individuals were chosen based on their varying skills to guarantee diversity within the groups. The identified skills for the project were "content writing, illustration, photography, layout, typography, software, and knowledge of print production" (Taneja, 2022). There was some resistance from some students who wanted to work with friends, but the instructors thought it would be counterproductive. When students work with friends, they may be hesitant to provide honest criticism or challenge each other's ideas, fearing that it could damage the interpersonal dynamics of the group (Le, Janssen & Wubbles, 2018).

To increase groups' productivity, instructors did not allow the self-selection of group members. Each group had at least one member with each of the identified skills. Students collaborated at three levels: Collaboration with group members was the project's central collaboration point, with team members working together at different stages and addressing design challenges. They also connected beyond regular class hours employing various digital collaboration tools for feedback and project monitoring. Besides the group members, the class collaborated to contribute their previous semester's coursework for the books. They shared their learning notes and sought feedback from classmates for content and design clarity. Further, the instructors helped refine and edit the content for the books (Taneja, 2022).

The Design Process

The design process encompasses a range of activities—analysing the situation from different perspectives, defining the problem, exploring ideas, creating prototypes, conducting tests, receiving feedback, making improvements, and ultimately delivering the final solution or end-product. The stages of a design process are iterative and may not follow a strict linear progression (Taneja, 2022). According to Dorst, the design activity stage is often described as the 'learning by doing' approach and is a key aspect of creating authentic learning environments in PBL (Dorst 2006 as cited in Ellmers, 2014). Groups A to D independently chose themes for their books, detailed in Table 3. Students actively participated in all design stages, from synthesising design briefs to prototypes that facilitated feedback and refinement. They were intensely involved in pre-production, production and post-production decisions. The project offered learning opportunities through multiple intermediate activities supporting research, collaboration, visual design, and systemic thinking. Students were engaged in problem-solving and critical thinking through extensive group discussions at all project stages. Figure 2 outlines the project's key stages.



» **Figure 2:** *Main Stages of the Design Process (Taneja, 2022)*

[4] A design brief is a document prepared to guide designers throughout the project. It outlines the background, purpose, scope, deliverables, end-users, stakeholders, project timeline, budget, etc. to facilitate decision-making at different project stages right from the project conception to its completion.

Guidance and Scaffolding

In education, scaffolding refers to instructional techniques used for a progressive movement of learners towards stronger understanding and independence in the process of learning. Educators offer different stages of temporary assistance to students, allowing them to attain higher levels of understanding and skills that they would not have been able to achieve without guidance and support (Great Schools Partnership, 2015).

The group projects were divided into three main stages. Each stage was broken down into smaller tasks to give an overview and provide a structural framework for the design project as indicated in Table 1 and 2. Blumenfeld et al. (1991) contend that teachers should employ scaffolding techniques akin to those utilized by experts, breaking down tasks and employing methods such as modelling, prompting, and coaching to teach problem-solving strategies, progressively transferring autonomy to students. Grant (2002) expands on this idea, stating that these scaffolding techniques may involve interactions between students and teachers, practice resources, peer guidance, guiding questions, support tools, project frameworks, and similar aids.

Table 1

Task break-up for scaffolding (Taneja, 2022)

Project Stages	Scaffolding Plan
Stage 1	Anatomic structure of publications Study and analysis of well-designed publications Design brief articulation—objective, users, tone of voice, timeline User study Concept development Content development, curation and organization · Content system and hierarchy Pre-production planning—substrate, printed size, binding techniques, production technology. Visual strategy · Visual design—grids, margins, columns, gutter-space, header, footer, negative space · Typography—type pairing, point size, leading, kerning, line length, drop letters, indents, page numbers, text hierarchy · Colour—primary, secondary and tertiary colour palettes · Image making—illustrations, photographs, icons, infographics etc. · Image management—scan, image size, resolution, edit, colour mode · Visual system design · Book cover/Dust jacket
Stage 2	Prototype Feedback and Refinement
Stage 3	Pre-production—print run, artwork, proofs Production Post-production—UV, embossing, creasing, folding, cropping, lamination, binding, etc.

Note:
Production requirements were considered across all course stages. Certain intermediate tasks were characterised by iterative approaches rather than adhering strictly to a sequential progression.

Table 2

Guidance and Scaffolding Provided During the Three Stages

Project Stages	Guidances
Stage 1	Recurring discussions & formative feedback for clarity of steps in Stage 1: · Case studies of professional work · Developing, curating & organising visual & written content · Visual strategy feedback & refinement loop · Key decisions at the pre-production stage · Collaboration tools to connect after-hours
Stage 2	Discussion & formative feedback for clarity of steps in Stage 2: · Understanding paper sizes, GSM, and coated/uncoated stock, UV printing, etc. · Visual strategy, prototype, feedback & refinement · Case studies for the design of book covers & dust jackets · Staying connected outside of teaching hours
Stage 3	Discussion & formative feedback clarity of steps in Stage 3: · Prototype, feedback, proof-reading, editing · Artwork for the production stage · Specification sheet · Post-production steps · Staying connected outside of teaching hours

Use of Technology

Technology can play a significant role in motivating students and teachers by facilitating the availability of information, implementation, and production of artefacts. Participants of this study worked on a professional publication design software prevalent in the industry and used by professionals. This allowed them to emulate tools used by experts to produce artefacts. The students were trained in using this software through earlier exposure. Comfort in using the software facilitated explorations of ideas, altering representations, and developing the artefact with ease and comfort. Blumenfeld et al. (1991) emphasize that students' familiarity and proficiency with software enhance motivation. Mastery of software applications encourages students to explore alternative approaches and take risks. The use of internet technology for secondary research, real-time collaboration tools such as concept boards, Google Docs, video conferencing for presentations and discussions, mind mapping tools, and social media groups to stay connected throughout the course allowed the project work to be continued beyond the university studio hours.

Integrating modern technology into PBL enhances student engagement, fosters real-world connections, and adds authenticity to projects. Students can present their outcomes to a larger community through social media campaigns, blog posts, films, or podcasts, amplifying visibility and impact. Modern technological tools support real-time collaboration, streamline the design process, facilitate data collection for research, and improve outreach, ensuring that project outcomes effectively reach

the intended audience, users, and stakeholders, thereby maximising their impact. Some technological tools for utilisation during PBL are mentioned in Table 3. Further, artificial intelligence tools (AI) can be integrated into research, data-analysis, problem-solving and presentation development. The tools mentioned in Table 3 have integrated AI to facilitate the users with predictive text, grammar and spell-check, automated meeting summaries, chatbots, transcriptions, content recommendations, etc.

Table 3

List of some technology tools that may be utilized by the design students during PBL

Category	Technology Tools
Real-time Collaboration	Google Docs, Google Jamboard, Miro Board, Concept Board, Google Meet, Zoom, Microsoft Teams, Webex Meetings, Skype, Slack, Microsoft Whiteboard, Nuclino
Design Process	Jamboard, Miro Board, Concept Board, Figma, Canva, Trello, Asana
Data Collection for Research	Zoom, Microsoft Teams, Typeform, Google Forms, SurveyMonkey, Otter.ai
Outreach	Google Meet, Zoom, Microsoft Teams, Webex Meetings, Skype, BlueJeans, GoToMeeting, Twitter, Facebook, LinkedIn, Instagram, Threads
Sharing Project Outcomes	Behance, Dribbble, Vimeo, YouTube, Medium, Weebly, Wix
Documentation Tools	Wedocs, Clickup, Betterdocs, Scribe
Artificial Intellengence (AI) Tools for Image Generation and Visual Enhancement	Midjourney, DALL-E, Let's Enhance, Leanardo.AI, Adobe Firefly, Vizcom, Jasper.ai, Khroma, Autodraw

Artefacts

Study participants went through various stages in the design process before they designed the final artefact. The four groups, from Group A to Group D, successfully designed four books, as mentioned in Table 4.

Table 4

Details of Final Artefacts Made in Four Different Groups (Taneja, 2020)

Group	Book Title	No. of Pages
Group A	Type Under Construction	256
Group B	Identity Please	368
Group C	Bidi and Bori – Packaging Graphics	188
Group D	Nirma University	204

The books designed by the students were printed as final finished products and presented to university officials for feedback. Annexure 1-2 shows the photographs of the four books designed by the students.

In PBL, students collaboratively tackle real-world challenges, producing tangible outcomes presented in a public setting (Jones, 2019). The artefacts represent students' proposed solutions, reflecting the evolution of their knowledge. These tangible outcomes, such as models, reports, videotapes, or computer programmes, facilitate feedback through presentation and critique. This process offers opportunities for reflection and refining the artefact to enhance their emerging knowledge (Blumenfeld et al., 1991).

Authentic Assessment

One of the key aspects of PBL is the emphasis on authentic assessment. PBL is a process-driven approach, thus, the assessment must also focus on the learning journey rather than just the final outcome for a holistic view of students' performance. "Authentic assessments are formative, not summative", thus, must take place during the learning process. The information about the strengths and weaknesses collected in transit to give feedback improves the quality of learning and eventually the learning outcome (Parwati et al., 2019).

Authentic assessment in PBL may take various forms where the students may create working models or prototypes and present their findings to an expert panel or stakeholders for evaluation or feedback.

Krajcik & Blumenfeld (2005) insist that the feedback must be extensive and preference must be given to individual feedback over group feedback. Blumenfeld et al. (1991) stressed that for assessing the learning of the students, knowing what they already know before the project commences is important. Unconventional assessment based on observing the journal or notebook entries, portfolio reviews, and examining students' discourse works better for PBL as opposed to conventional methods such as standardised tests or workbook questions. Furthermore, the integration of self-assessment and peer assessment can make PBL very effective. Mansur & Alves (2018) have stressed that the formative method of peer assessment and self-assessment helps provide feedback during the project process phase, leading to more adaptive and effective learning.

Self-assessment encourages reflection about the learning experience, key decisions and actions, and develops critical thinking and problem-solving skills. The course instructors may design a rubric to address the key areas—core domain knowledge and skills, collaboration, technical skills, critical thinking, problem-solving, communication, presentation skills and artefact or the final outcome.

The formative and summative assessments which are comprised of self-assessment, peer assessment, the instructor's evaluation, and feedback from the community can be fruitful and holistic in the case of PBL.

Conclusion

The study helps enhance understanding of PBL. It also gives clarity about how the real-world project may be interpreted in the context of graphic design education. The PBL framework proposed in the study was successfully applied in the studio classroom of the year III communication design programme.

The popularity of design education is on the rise in India. While there is an emphasis on real-world projects in teaching design, there is a paucity of industry projects in the academic setting, which increases the dependence on hypothetical projects. The popular phenomenon of working on industry projects to which institutes have limited access may be substantiated by projects generated within the university or the institute to meet their graphic design requirements; this outlook can help bridge the gap of academic-industry partnerships and enhance transferability to the professional world. Generating real-world opportunities with an authentic context to fulfil an actual graphic design requirement in an academic space can be a win-win situation for both the institutes/universities and the students. Thus, such opportunities must be identified or generated for an enriched learning experience and fulfil the need to prepare students for the real-world. Be it designing the promotional material for an event or the annual calendar or planner—the real-project can lead to real-learning.

However, it may be noted that different learning pedagogies may be appropriate for different learning stages. At some stages, an application-based approach to developing disciplinary foundational skills is apt. At a different learning stage, a hypothetical approach may be necessary to achieve a curricular milestone. Furthermore, for the successful implementation of PBL in which students deliver implementable solutions, learners must acquire some core disciplinary knowledge and skills before they embark on this journey. It was observed that group formation based on individual skills may compromise the overall learning experience by limiting students to perform only in the area of their proficiency. Instructors must ensure that the overarching course learning objectives are met by all the participating students by encouraging their active participation at different project stages for a holistic learning experience. The course duration must be long enough to give students enough time for optimal results in PBL. Thus, it would be ideal to have the course continuously, at one go, rather than having more than one parallel course input, as that might hinder the flow of the PBL project.

The proposed framework covers all the essential ingredients to realise a successful project in the area of graphic design. The framework may also benefit allied disciplines in design and serve a larger community of design educators. While there is literature on PBL, it is unrelated to the graphic design context. This study not only addresses the problem of identifying projects that fall under PBL for graphic design education but also serves as an example for educators to implement the framework for the best results of PBL pedagogy.

In the era of revolutionary technological advancement and available AI tools, future research could study how, within the existing framework these tools may be integrated to improve the learning journey.

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Annex 01 - Group A Book Title: Type under Construction

Annex 02 - Group B Book Title: Identity Please

Annex 03 - Group C Book Title:
Bidi; Bori, Packaging Graphics

Annex 04 - Group D Book Title:
Nirma University