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Sustaining learners' interest: Applying IDC theory in a semester-long project-based learning course

Vishwas Badhe [1] *, Sunita Raste [1], Sahana Murthy [1] and Sridhar Iyer [1]

*Correspondence:
vishwasbadhe@iitb.ac.in
Centre for Educational Technology, Indian Institute of Technology Bombay, Powai, Mumbai, Maharashtra 400076, India
Full list of author information is available at the end of the article

Abstract

Learners' interest fluctuates in semester-long courses due to various reasons. Sustaining learners' interest is difficult and it becomes challenging for instructors in a project-based learning (PBL) course. This qualitative study involved 17 postgraduate and Ph.D. participants. Keeping focus on the interest loop (triggering, immersing, and extending) of interest-driven creator (IDC) theory, it examines how instructional strategies helped sustain learners' interest in a semester-long instructional system design (ISD) course. Course participants were offered a real-world project with the objective to create training to raise awareness about needs and issues of persons with disabilities (PwD) in an educational institution. The qualitative data was sought in the form of verbal interactions from the classroom, individual learner interviews, surveys, and weekly shared reflection journal. The indicators for trigger, immerse, and extend of interest loop given by IDC theory was mapped with the learner response using deductive categorization method. Findings indicate that the thoughtful application of IDC theory (*interest loop*) while formulating and implementing instructional strategies have helped learners sustain their interest throughout the course. The social value carried by real-world PwD project (*website*) has helped in triggering initial interest among learners. The empirical evidence of sustained interest throughout the course is presented on activity and course level. Additionally, the detailed theoretical interpretation of the interest loop from the IDC theory is presented in this paper along with further research directions. Overall, this paper presents the empirical evidence of triggering, immersing, and extending learners' interest using IDC theory *(interest loop)*.

Keywords: interest loop, instructional systems design (ISD), interest-driven creator (IDC) theory, project-based learning (PBL), real-world project, persons with disabilities (PwD)

Introduction

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A typical instructional system design (ISD) course covers a conceptual understanding of instructional design models (for example ADDIE model), applications of these models, and often, the execution of an instructional design project (Reiser, 2002). Many ISD courses adopt a project-based learning (PBL) approach, in which learners engage with real-world problems, learn through hands-on activities, discuss their ideas, and apply concepts to solve given problems. PBL helps to increase learners' engagement and develop a deeper understanding of important ideas by facilitating opportunities for problem-solving, decision-making, and explaining their thinking (Krajcik & Shin, 2014). However, in projects spanning a semester-long course, learners' interest may fluctuate significantly. At the university level, learners come with varying levels of interest in their domain of study, often representing personal choices and preferences. This implies that certain mandatory courses may encounter learners with little or no initial interest in the subject matter (Fryer et al., 2016). While the potential for interest resides within the individual, its direction and growth are shaped by the content and the surrounding environment (Hidi & Renninger, 2006). Rather than viewing interest as simply present or absent, research should examine how to foster an individual's willingness to reengage with specific content over time (Hidi & Renninger, 2006). This makes maintaining learner interest throughout semester-long projects particularly difficult and effort-intensive.

Despite the promise of PBL to engage students through real-world problem exploration, sustaining learner interest throughout semester-long implementations remains a significant pedagogical challenge (Blumenfeld et al., 1991; Wong et al., 2020b). Research has identified several critical pitfalls that cause systematic interest decline in PBL contexts. First, the inherent characteristics of authentic projects create ambiguity that adversely impacts interest. Their ill-structured nature, cognitive complexity, and lack of a singular correct answer, especially when assessment structures are mismatched to these demands (Penuel et al., 2025), often result in minimal effort or project abandonment (Blumenfeld et al., 1991). Second, even when initial situational interest is successfully triggered, it frequently becomes fleeting as the "information gap" closes (Chan et al., 2018). Students often perceive necessary foundational tasks, such as reading scientific literature or acquiring content knowledge, as tedious "busy work" rather than valuable activities (Bennie et al., 2025). Third, inadequate scaffolding combined with overwhelming activity demands leads to high frustration levels, thereby decreasing interest. Students struggle with self-directed aspects like planning, time management, and data analysis without systematic support (Thomas, 2000). These implementation difficulties are further confirmed by challenges in managing the learning process and securing institutional support (Meng et al., 2023; Bennie et al., 2025), which necessitate clear design principles for teacher training to sustain effective practice (Miller et al.,

2021). Finally, an examination-driven educational culture, prevalent in Asian contexts and reflected in teachers' assessment considerations, further transforms learning activities into burdens, diminishing student enjoyment and distorting the learning process (Chan et al., 2018; Wong et al., 2020a; Penuel et al., 2025).

This systematic decay of interest in prior PBL implementations establishes a clear need for a targeted theoretical framework. The IDC theory (Interest Loop) is specifically designed to address this challenge by focusing on three phases: initiating interest (Triggering via strategy), sustaining interest (Immersing via Flow), and developing emerging long-term interest (Extending via Meaningfulness) (Wong et al., 2020a). IDC's emphasis on helping learners perceive the target domain as relevant to their authentic daily lives is particularly crucial, as it directly counteracts the identified pitfalls of fleeting interest, perceived busy work, and lack of real-world connection. We show how the challenges above were addressed by the IDC theory-based course design, and provide evidence that the activities and scaffolds supported learners in sustaining interest.

This study reports on a semester-long graduate level core course - ISD for Ph.D. and MTech study program in Educational Technology in a top Indian educational institute. During this course, learners were provided an opportunity to work on a real-world project. One of the goals of the course was to reduce the gap between skills taught in formal education and those used in professional settings and thus promote meaningful learning (Dillenbourg et al., 2019). Using real-world problems in project-based learning provides learners with more relevant learning opportunities (Rohm et al., 2021). As suggested by Fryer et al. (2016), the interest sparked and sustained by the particular activities and tasks within a course can influence learners' long-term interest (or disinterest) in that course, which subsequently affects their interest in the broader field of study. Activities in this course were particularly designed to trigger and sustain students' interest in the course by leveraging Interest Driven Creator (IDC) theory. According to Chan et al. (2018), situational interest arises from environmental factors that stimulate an individual's attention toward a specific object or occasion, generated by the learning environment or the unique features of a particular learning task.

In the ISD course, the instructor proposed a real-world course project resonating with the learners and involving stakeholders from their immediate social circles within the institute community. The relevance of this project acted as an effective motivational factor triggering learners' initial interest in the course project. The project involved creating a website and corresponding resources such as videos and infographics to raise awareness and sensitize the institute community towards the challenges and needs of persons with disabilities (PwD). The project posed an ill-structured challenge which demands a high level of motivation. As Amabile (1997) highlights, intrinsic motivation—driven by interest, involvement, excitement, satisfaction, or personal challenge—is

crucial for creative engagement. This perspective positions application of IDC theory in alignment with motivation theory, as both emphasize sustaining learners' interest and intrinsic drive in a semester-long project-based learning course. To further maintain learners' interest throughout the course, task specific activities were designed in accordance with the IDC theory. In this article, we elaborate on learners' interest in the ISD course, providing evidence for triggering, immersing and extending components of the "Interest" loop from IDC theory.

The research study took place within the context of the ISD course, where research and teaching assistants closely observed the process of creating and developing the PwD project. Within the PwD project we had four problem themes: locomotor disabilities, visual impairment, attention deficit hyperactivity disorder (ADHD) and learning disabilities (LD), and Autism. The alignment of IDC theory with the ISD course occurred on two levels: macro and micro. At the macro level, the course structure itself was designed so that a socially meaningful project effectively "triggers" initial interest, while structured active learning activities, such as an exploration of the TPACK framework, facilitate "immersion." The process concludes as the application of learned concepts to the project serves to "extend" student interest. The PwD project emerged from the learners' interest and planned efforts throughout the semester containing micro level course activities created in alignment with the IDC theory's interest loop. A detailed analysis and evidence of this activity-level implementation is presented in the episode in section 5.1. Similarly, detailed analysis and evidence of course-level implementation is presented in the sustained interest throughout the course in section 5.2

The research question being examined is: How did the instructional strategies help sustain learners' interest in a semester-long project-based learning course? To address this research question, we used learners' verbal interactions in the classroom, learner interviews, self-report surveys, and weekly reflection journal to provide empirical evidence of learners' sustained interest.

Theoretical basis: interest and IDC theory

Dictionary definitions of interest encompass both an emotional state, "a feeling of wanting to learn more about something or to be involved in something" (Interest, n.d.)- and a cognitive state, "a quality of holding attention" (Interest, n.d.). Similar ideas have been supported in research where interest has been shown to be a crucial element of the learning process and is considered as an emotional state that can be triggered by specific situations (Ainley, 2006). In formal definitions from educational psychology and the learning sciences, interest has been characterized as the interaction between a person and an object, such as learners' meaningful participation with content (Renninger et al., 2018). It has been argued that interest is key in guiding behavior and attention and that it

promotes learning and inspires effort (Dewey, 1913). A meta-review of studies of interest has indicated its importance in learning (Schiefele, 1996). Various models of interest development have been proposed, a prominent one being the four-phase model for interest development: triggered situational interest, maintained situational interest, emerging individual interest, and well-developed individual interest (Hidi & Renninger, 2006).

The Interest-Driven Creator (IDC) theory is a macro-level design theory proposed in Asian contexts to prepare learners for ill-structured and unpredictable real-world problems (Chan et al., 2018). The theory is based on three anchored concepts: interest, create, and habit, with the premise that learning becomes enjoyable and effective when learners learn with interest; creation further makes learning productive and successful; and instilling the habits of creating with interest can lead to learners becoming lifelong interest-driven creators (Chan et al., 2018). IDC theory has been successfully implemented across different regions throughout Asia. In Malaysia, it was applied in educational technology courses to instill innovativeness among learners (Khambari, 2019) and ignite their interest in educational technology (Wong et al., 2020b). In Taiwan, IDC has been implemented in an experimental school across subjects such as reading, writing, mathematics, science, English language, and social studies (Wong & Wong, 2019), while Kong (2016) used IDC theory to develop computational thinking for K-12 learners in Hong Kong.

IDC theory is a well-suited framework to address the challenges of PBL in semester-long implementations. While established frameworks such as the ARCS Model (Keller, 1987), Self-Determination Theory (Deci & Ryan, 2008), and Hidi and Renninger's (2006) Four-Phase Model of Interest Development provide valuable insights into motivation and interest, IDC theory offers distinct advantages for addressing the longitudinal sustainability challenge. Unlike these frameworks, which are largely descriptive or focus on single-component interventions, IDC theory provides a prescriptive, multi-component design strategy through the interest loop (triggering, immersing, and extending), specifically designed to transition fleeting situational interest into sustained individual interest (Wong et al., 2020a; Dillenbourg et al., 2019). Importantly, IDC theory was developed to address the examination-driven educational culture prevalent in Asia, which emphasizes knowledge duplication and diminishes students' interest in learning, often resulting in teaching activities that students find boring (Chan et al., 2018; Wong et al., 2020a). The framework fosters interest development in contexts where international assessments reveal high achievement but paradoxically low interest and confidence, as observed in regions like Hong Kong, Singapore, and Taiwan (Wong et al., 2020a).

The Interest Loop consists of three interconnected components that work together to create meaningful learning processes. The first component, triggering, involves

presenting a task or question that sparks initial curiosity and interest in learning. The second component, Immersing, entails engaging learners in activities that capture their attention and achieve a state of flow by balancing challenge and skill while providing systematic scaffolding, directly addressing students' struggles with self-directed tasks and frustration. The third component, extending, emphasizes meaningfulness by helping learners integrate prior and new knowledge into activities they perceive as relevant to their authentic daily lives (Wong et al., 2020a), thereby counteracting the perception of necessary tasks as tedious "busy work" (Chan et al., 2018). These action words call for educators to use them as springboards for student-centered learning that results in deeper immersion in learners' interests (Roschelle & Burke, 2019). Critically, IDC theory links interest development to concrete artifact creation, addressing the transfer problem and inert knowledge concern (Thomas, 2000), and fosters self-directed habits of creation essential in examination-driven educational contexts (Chan et al., 2018). This systematic, phase-specific approach provides the operational design guidance needed to sustain interest throughout semester-long PBL courses, making IDC theory a strategically appropriate choice for this study, which focuses on the implementation of the Interest Loop and its associated components.

Course design and orchestration

Instructional system design (ISD) is a postgraduate course for Masters and Doctoral students in the Centre for Educational Technology at our educational institute. This 6-credit, semester-long course covers instructional design (ID) models (e.g., ADDIE, SAM), techniques (storyboarding, needs analysis, expert feedback), technologies, ID project procedures, conceptual understanding of TPACK framework, and pedagogical models for learner-centric online learning. The course equally emphasizes conceptual understanding and application to real-world concepts. The Spring 2023 course had 17 learners. The course was taught primarily in a physical mode but included a hybrid setup to facilitate flexible execution for learners who could not attend a particular class physically. For a hybrid setup, Zoom™, an online video conferencing platform was used for synchronous class sessions. Over sixteen weeks, fourteen 3-hour classes were held for which learners assembled in a single classroom with four physical breakout rooms so that groups could collaborate on the project. The Zoom™ and face-to-face class sessions were video recorded.

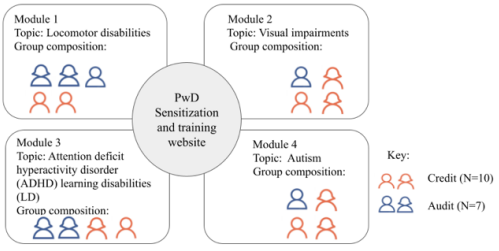
The course adopted a project-based learning (PBL) approach, in which learners worked on the design and development of a website intended to raise awareness about persons with disabilities (PwD) within the context of our educational institute. Project-based learning pedagogy includes six key features: (a) learning goals, (b) collaboration, (c) a focus question, (d) engagement in scientific practices, (e) scaffolding with learning

technology, and (f) the creation of tangible solutions useful for addressing real-world problems (Krajcik & Shin, 2014). In project-based learning, learners interact with the problem and learn by doing, discussing, and applying ideas as they work toward a solution. This process enhances their engagement and supports a deeper understanding of key concepts by providing opportunities for problem-solving, decision-making, and articulating their ideas (Krajcik & Shin, 2014). The course topics, class activities, and homework were structured around the PwD website project. Learners worked in groups, each focusing on a specific type of disability, to create different modules of the website. Figure 1 shows the topics and group composition for each PwD module, which were finalised collaboratively after detailed discussion among instructors, students and TAs in the initial class. Three hours per week were allocated to the course, comprising both conceptual learning and project work. In addition, learners were expected to spend 3–4 hours per week on homework and the project. To support project activities, four rooms were set up for each group to collaborate.

The instructor used multiple active learning strategies in the classroom to facilitate learner engagement. This included activities such as think-pair-share (TPS), each-one-say-one, and peer instruction (PI), where an anchor question was given to drive the discussion among learners in the class. Additionally, the instructor encouraged learners to use a weekly shared reflection journal to post their reflections each week. Muddy points and productive digressions were drawn from learners' reflections in a shared reflection journal and discussed in the class to enhance learners' understanding through constructive and critical feedback from instructor and peers.

Figure 1

Types of disabilities covered under the PwD website and group composition



The instructor designed six in-class activities. The topics chosen by the instructor, such as TPACK, learner-centric MOOC model, and what makes a training resource, were aligned with the real-world nature of the task and helped learners cope with the cognitively complex demands of the PwD project. This was the implicit support provided

to enhance PwD website resource creation activities. The overall approach in designing class activities was to foster interest and make learning both enjoyable and effective. Contextual and engaging activities were created to tap into learners' individual interests. Timely and appropriate support was provided during the activities to fine-tune the interest. Socially relevant and real-world tasks were incorporated to help learners apply their knowledge and further advance their learning. Each activity was planned for about 20-30 minutes. Each class had dedicated time allotted for group presentations and project updates, followed by the feedback by instructor and learners. Subject matter experts (SME) and other persons with disabilities from the institute participated in three feedback and interaction sessions conducted throughout the course, led by the instructor. To further understand PwD's needs and challenges, the teacher and course team organized a 3-hour workshop with a prominent organization working on developmental and learning disabilities.

Method

Participants

The course included seventeen participants (Mean age = 32.17 years, Min = 27, Max = 43, SD = 4.17), comprising 8 male and 9 female learners. Among them, fourteen participants were enrolled in the PhD program in Educational Technology (ranging from 2nd to 5th year), and four were from the Master's program in Educational Technology (all in their 2nd year). Of the fourteen PhD participants, five were senior PhD learners in their 4th or 5th year. All course participants had a STEM background, and eight of the seventeen participants had formal teaching experience, which ranged from 2 to 17 years.

Data collection and data analysis

To investigate learners' interest, data related to learners' interest were collected from four sources and analyzed. The unit of analysis and other details are provided below.

i) Verbal interactions in the classroom through video recordings

There were a total six in-class activities designed and conducted over 12 sessions in alignment with the interest loop. Each session lasting ~3 hours, was recorded throughout the course. The in-class activities planned are as follows: 1. Classroom learning dialogue on "What is a training resource" 2. Classroom learning dialogue on "TPACK" 3. Group activity on "Implementation of TPACK in PwD project" 4. Classroom learning dialogue on "Implementing the principles of learner centricity" 5. In class peer feedback and evaluation 6. In class evaluation by PwD's and subject matter experts. Out of these six activities two activities were selected to illustrate detailed manifestation of trigger,

immerse, and extend phase of interest cycle. Overall unfolding of these phases of interest loop was analyzed independently by two experienced educational technology researchers. We selected episode that has:

- Visible indicators of triggers, immerse, and extend phases of interest cycle.
- Been executed with whole class and involving maximum number participants involved (i.e. >=80% of the total participants)
- Recording with clarity and less noise.

Two episodes were selected based on the above-mentioned criteria. One of these episodes, titled 'What is a training resource?' has been reported in previous work (Badhe et al., 2023). This article focuses on the second episode: classroom learning dialogue on "TPACK". While learning complex concepts like TPACK, going through a theoretical perspective alone is not sufficient. Hence while selecting topics taught in the course, a strong effort was made to go beyond the theory and connect with the interest loop. In this particular episode, the goal of the instructor was to understand how IDC theory interest loop operates in TPACK. To analyze this episode, we began by transcribing verbal interactions from the classroom and group activities. The coding procedure focused exclusively on learners' verbalized interactions, excluding other cues such as tone, body language, and gestures. Large conversational segments, including multiple conversational turns that revolved around a specific topic of discussion in the classroom or group activities were examined for the presence of interest. A conversational segment was conceptualized as an episode of the interest cycle if it began with indicators of the trigger component, followed by indicators of the immerse component, and concluded with indicators of the extended component. Anchor questions posed by the instructor to facilitate classroom discussions or group activities often acted as the triggers for these episodes.

The unit of analysis for verbal interactions in the classroom and group activities was a single conversational turn that represented a thematically consistent verbalization by a single learner. Turns taken by learners were analyzed to identify each component of the interest cycle, namely triggering, immersing, and extending. To map learner turns to the corresponding components of the interest cycle, a deductive categorization method of content analysis was employed (Mayring, 2015, p. 95). An a priori list of relevant indicators for each phase was derived from the literature (Chan et al., 2018; Wong et al., 2020a) to code the conversational turns (shown in Table 1).

ii) Learners' reflections on their learning via a reflection journal

Learners' reflections on their learning were collected asynchronously through a reflection journal. After each class, the instructor would post an anchored question in the

reflection journal to refine learners' conceptual understanding. Learners were expected to engage in a three-dimensional reflection experience through different perspectives: 1) As learners, reflecting on their own understanding and making abstract connections. 2) As teachers, supporting peers through feedback and assignment design. 3) As researchers, exploring educational technology research opportunities within the course. Learners could comment on others' reflections and post follow-up questions for clarification or further discussion. The instructor reviewed each reflection, provided comments from an ISD perspective, and facilitated short classroom discussions when necessary.

The unit of analysis for the reflection journal data was a single written response by an individual learner. Each response corresponded to a thematically consistent written discourse or to an anchored question posed by the instructor. Learner responses were coded (using a coding scheme shown in Table 1) to identify components of the interest cycle, namely triggering, immersing, and extending, similar to the indicators used to analyze classroom discourse.

iii) Interest survey questionnaire

We administered a survey questionnaire in Week 8, immediately after the mid-semester exam, to understand learners' interest in the course. This survey consisted of a total of five questions, including two open-ended questions and three Likert scale items on a scale of 1-5 ranging from strongly disagree to strongly agree substantiated by follow-up probing questions through examples. The open-ended questions explored topics such as the participants' initial interest in the ISD course (e.g. *What triggered your initial interest in the ISD course before you joined it?*) and their anticipation of attending classes (e.g. *I look forward to attending every ISD class because* _____ .). The Likert scale items assessed aspects such as enjoyment of classroom activities (e.g. *I enjoy the activities of the class, being unaware of the passage of the time*) and perceptions of the Pwd project as an engaging application of the course content (e.g. *I find the Pwd project an interesting extension and application of what I am learning in the course.*). The detailed mapping between survey questions and phases of interest cycle is shown in the Appendix 1.

The survey was administered during the face-to-face classroom session and no peer interactions were allowed while responding to the survey questions. The unit of analysis for the open-ended questions was a response by an individual learner. The learners' responses were coded using the indicators mentioned earlier to identify components of the interest cycle (shown in Table 1). For Likert scale questions, we have used learners' extent of agreement for the given question statement on the 5-point likert scale.

iv) Individual semi-structured interviews at the end of the course

We conducted 20-minute individual semi-structured interviews with learners at the end of the semester to gain insights into their individual interest throughout the ISD course and the PwD project. The ISD course involved ill-structured problems, and the instructor designed activities around them in which learners actively engaged. The instructor triggered their initial interest, immersed them in a state of flow, and further enabled them to extend their acquired knowledge in the PwD project. To probe their interest at the course level, we prepared objectives for the three phases of the interest loop. Under each objective, we formulated questions related to course design and experienced interest. For example, the objective for *trigger* was to understand 'learning approach comparison,' explored using the question: *What are the key differences between learning through traditional lectures and learning in the ISD approach, where real-world problems guide problem-solving?* The objectives for *immerse* were to understand 'interest influencing factors, most engaging activities, and interest trajectory throughout the course,' explored using the questions: *What specific factors positively or negatively influenced your interest at different stages of the course? Which specific activities—both in-class and out-of-class—engaged your interest most? Can you describe particular instances that sparked your curiosity? Can you describe your interest level at three key points (start, mid, and end) in the ISD course?* The objectives for *extend* were to understand 'out-of-class engagement,' explored using the questions: You invested considerable time creating resources outside class hours. *What kept you interested in continuing this work? What challenges did you face, and how did you overcome them?* The detailed interview protocol and its mapping with phases of interest cycle is shown in Appendix 1. The interview protocol was developed by a senior post-doctoral researcher specializing in educational technology, in collaboration with the course instructor.

The end-of-semester interviews aimed to explore learners' interest throughout the course. Learner interview responses were transcribed and used for analysis. The unit of analysis for the semi-structured interview data was a response to a single interview question by an individual learner, which was coded using the indicators mentioned earlier to identify components of the interest cycle (shown in Table 1).

Although additional data were collected from other sources during the ISD course, these data were not included in the analysis of the interest cycle based on IDC theory. The additional data sources included: a) Learners' performance throughout the course including assignments, mid-term, and final exams. b) Time spent survey – information on how much time learners spent weekly outside class on ISD-related project work. c) PwD project website as an artifact – collaboratively created PwD website and resources. d) Researcher observations – notes about in-class indicators of the interest cycle.

Table 1

Coding scheme used for deductive categorization method while analyzing trigger, immerse, extend phases of learners' interest.

Code	Indicators from literature	Definition from literature	Excerpts from interview	Excerpts from survey
Trigger	Eagerness to participate, Curiosity, Desire to know more	Triggering the students' situational interest by tapping into their curiosity. Providing incongruous and surprising information around what is to be learned can intrigue students as well as point out an information gap. Emergence of epistemic curiosity is the consequence of a knowledge gap between what a person knows and what (s)he desires to know.	Example: "*The reason for having good interest was the project and the stake of the project, because I was very much interested in how it's going to be implemented.*"	Example: "*As far as I remember, the only motivation for taking this course was to contribute to the project as the project outcome had huge implications on someone's academic life*."
Immerse	Tackled the task at hand, State of flow: engagement in the activity for its own sake, Concentration of attention	When students experience flow, they seek out increasingly greater challenges while devoting more attention to stretch their skills to confront such challenges, resulting in personal development as well as feelings of efficacy, an experience of intense emotional involvement, being completely engaged in the activity for its own sake.	Example: "*How it (class) was conducted, you know, how it was conversation drive, and how it was discussion oriented. So that was enough to hold the attention for longer duration, like three hours, and many of the times the class has to go beyond three hours. So, to grab or to hold the attention for that duration was mainly because they were discussions on different topics*."	Example: "*When we are putting forward our thoughts in class, we pay attention to responses we are receiving and when others are sharing something we don't know, it captures my attention. This leads to a wonderful learning experience*."
Extend	Assimilation of acquired knowledge in different contexts	Students who are engaged in the "extending interest" state may begin to generate curiosity questions on their own. Such questions (or other self-set challenges) enable	Example: "*Learning animation videos and learning how to write the script. She (team member) taught us how to systematically write every scene.*	Example: "*PwD project provides a holistic approach to applying the different concepts we are learning. The PwD project helps me to apply ADDIE model then*

	students to connect their present understanding of content to alternative perspectives that challenge them to reconsider what they do know and to seek additional information	*Then some logistics issue came. So, all those things were small little challenges which we overcame.*"	*SAM model and also the lesson plan. The Umeed workshop helped me to empathise with the issues they are facing rather than just reading someone else's story.*"

The data was coded by two trained educational technology researchers, and inter-rater reliability was assessed using Cohen's kappa (κ). Both coders were well-versed in IDC theory and project-based learning courses. In the first round, both researchers independently coded 11% of the total data (i.e., interviews and survey responses from two participants, and 11% of the in-class discussion responses from the TPACK activity and reflection journals). Discrepancies were then discussed and resolved through consensus in the second round. The coding of indicators of trigger, immerse, and extend phases of the interest cycle demonstrated high agreement between coders, with $\kappa = 0.80$ for in-class discussion responses (TPACK episode), $\kappa = 0.90$ for interview and survey responses, and $\kappa = 0.77$ for reflection journal responses. These results indicate reliable coding procedures, with overall kappa values reflecting substantial inter-rater reliability (Halpin, 2024).

Findings

In this section we provide the detailed analysis of an episode (TPACK activity) depicting the evolution of learners' interest in the three phases - trigger, immerse, extend – as a result of the implementation of specific activities. We show excerpts from the classroom discussion during the activity to identify indicators related to the trigger, immerse, and extend loops. In the following subsection, we show overall course level findings, organized according to each phase of the interest cycle, with analysis from survey responses, interviews and the reflection journal.

Episode: demystifying TPACK framework

This episode demonstrates a classroom activity facilitated by the instructor to simplify the TPACK (technological, pedagogical, and content knowledge) framework (Mishra & Koehler, 2006). An active learning method known as Each-one-say-one was used, in which learners had to take turns to provide one response to the given question prompt. Learners were situated in a face-to-face, co-located setting and were allowed to voluntarily choose the timing and order of their responses. The instructor commenced this activity by asking, "What knowledge is necessary to develop a training resource?"

The objectives of this activity were for learners to: a) recognize various knowledge components necessary for creating a training resource, b) identify the specific content knowledge (CK), pedagogical knowledge (PK), and technological knowledge (TK) required, and c) correctly select examples for TCK, PCK, TPK, and TPACK. The activity lasted for 21 minutes and concluded once most of the learners had participated at least once.

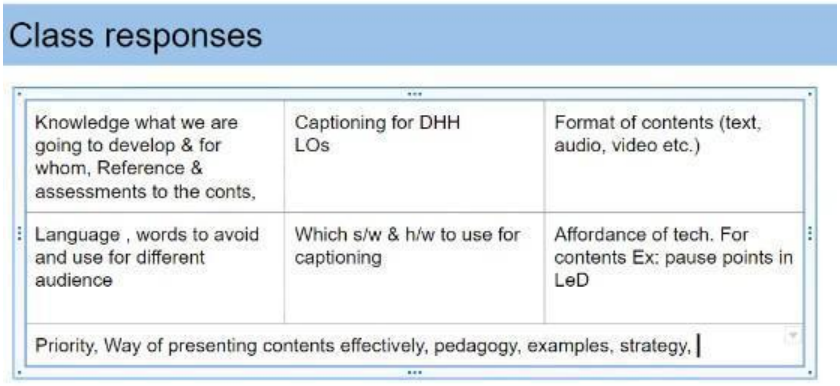
Triggering learners' interest

Design strategy

The instructor used an inductive strategy of concept formation where a question prompt was provided asking learners to share various types of knowledge required to design a training resource. The instructor intended to stimulate epistemic curiosity by making learners actively recall, compare, classify, and connect knowledge components to form a conceptual understanding of the various types of knowledge required to design a training resource. As demonstrated by Khambari (2019), through this activity, the instructor tried highlighting an information gap about the consolidated view of knowledge required to design a training resource, thereby encouraging learners to explore. Learners responded to the question prompt based on the concepts learned in the course and their experience working on the course project so far. Their responses were gathered and organized into distinct cells of a table displayed on the screen (Figure 2). At first, the table was devoid of any headers assigned to the columns or cells, and the instructor did not explicitly designate these responses as TK, PK, PCK etc. As the cells in the table began to be filled, learners attempted to provide additional responses related to the various knowledge components in order to complete the table. Only when most of the cells were filled did the instructor start labeling and classifying the responses based on the TPACK components.

Figure 2

Table collating responses of the each-one-say-one activity



Impact of strategy on triggering interest

While each learner was expected to respond once, 12 out of 15 learners spontaneously took turns recording 27 unique responses in six minutes. 5 learners took one turn whereas the remaining 7 learners took multiple turns ranging from two to five. The spontaneous participation by learners and their total responses show their eagerness to participate in the activity with piqued curiosity.

The activity question and table without headings were incongruous for learners. The instructor started writing learner responses in seemingly random cells in the table (Figure 2). Learners started peppering the instructor with questions about various knowledge components as necessary elements of a training resource.

> *S16: Sir, don't (we) need LOs [learning objectives] to be here?*
>
> *Instructor: Yes, LOs are here.*
>
> ..
>
> *S1: Assessments?*
>
> *Instructor: Yeah, it's also there. Written as references and assessments. One box is still empty for me.*

In these two excerpts, each learner was first trying to gauge their understanding of the required components based on their prior knowledge. They desired to know more in order to fill the gaps in their knowledge about the expected responses and to contribute effectively, displaying epistemic curiosity. They explored the activity in-depth to understand the unknown structure of the table, exhibiting specific curiosity. Overall, the design of this activity aroused learners' specific-epistemic curiosity thereby triggering their interest.

Immersing learners' interest

Design strategy

Since triggering interest is not necessarily effective in maintaining learners' interest, it is important to design the activity to engage learners' full attention, thus moving to immersing interest. Continuing the each-one-say-one activity, the instructor monitored learners' responses and probed them to identify and map the TPACK knowledge components with their responses (without revealing the concept name i.e. TPACK). The instructor posed a series of challenging questions to learners in order to help them identify the various types of knowledge required to design a training resource (Khambari, 2019). The instructor posed questions such as: "Instructor: As a teacher, what knowledge should you have? That's the question, not what should be there in the solution you design. As a teacher, what knowledge should you have before you start creating such a solution (training program)?" Along with this, various follow-up probing questions posed by the instructor are also presented in the excerpt below in this section. These follow-up probing questions challenged learners to focus on the activity for its own sake and generate more relevant responses by tackling the task at hand. Learners actively listened to others' responses and questioned each other to refine their understanding. After filling in all the cells of the table, the instructor helped learners understand the relationship between the various types of knowledge in different cells of the table. The instructor and learners together assigned headings to each cell, thereby identifying various components required to create a training resource and the corresponding type of knowledge inherently aligned to TPACK.

Impact of strategy used for immersing on learners' interest:

Despite their uncertainty about the outcome of the activity, they tackled the task at hand by giving detailed answers when their responses were questioned, showing their engagement in the activity for its own sake.

> *S12: What language should we use [while designing instruction]?*
> *Instructor: What language Hmm [...] By default language in [our university] is English.*
> *S12: No No, it's not about English. It's about which words to avoid and which should be used.*
> *Instructor: Ok. Which words to avoid and use, good point*

In this excerpt S12 first brought out the need for considering language while designing instruction. Upon being reminded by the instructor of the expected language in the educational institute, S12 clarified that it's not about the medium of instruction but about vocabulary that is familiar to the target audience. Though learners were unclear about how their responses would contribute to the table, they continued to engage in the

discussion by giving thoughtful explanations when questioned. The instructor asked learners to read the responses from the table (shown in Figure 2), try to understand the differences between knowledge components and attempt to identify the types of knowledge (TK, PK, CK, TPK etc).

> *Instructor: Ok. Now I have deliberately put it [responses] in these boxes [cells]. So, there is some difference between what goes in each box. Do you want to take two minutes and crack it? I will give you one hint. The boxes at top are simpler, then going down it becomes more complex. So how is the complexity happening? [5 seconds silence]*
> *Instructor: It's not an easy question, if you don't get it, it's fine. But it's worth thinking about. [10 seconds silence]*
> *S17: The granularity changes.*
> *Instructor: Yes.*
> *S7: The right side, first box contains only technology.*
> *Instructor: Ok. What does the second box contain?*
> *S7: Technology + Strategy*
> *Instructor: Technology + Strategy. So that's the direction to go.*

In this excerpt, multiple learners are seen to concentrate their attention towards the task. They made the effort to analyze the different types of knowledge and consider the instructor's prompts to frame their responses. The indicators in the above excerpts for immersing interest i.e. tackling the task at hand, engagement in an activity for its own sake and concentration of attention in an activity, show that the learners were in a state of flow.

Extending learners' interest

Design strategy

Continuing the episode, the instructor revealed that what was discussed so far was indeed the TPACK framework and that the responses gathered (in the first row) from the each-one-say-one activity could be grouped under three headings such as Content (CK), Pedagogical (PK), and Technological (TK) knowledge (see Figure 2). Further, the instructor explained how the second row is a combination of CK+PK, PK+TK, and TK+CK and the last row was a combination of CK+PK+TK, i.e. TPACK. The instructor mapped the learner responses (i.e. knowledge components) with correct headings and showed interconnection between different cells. Finally, the instructor showed the TPACK framework and explained it in detail. The instructor asked learners to think and give examples of CK, PK, and TK from different contexts such as the PwD project, virtual reality learning environment (VRLE), and classroom. The instructor presented the

scenario in which different knowledge components (from TPACK) were used and asked learners to guess the correct combination (i.e. TCK, TPK, PCK, or TPACK). The instructor stated the concept from the slide, asked for a correct example of it and at last concluded by summarizing the TPACK framework.

In this way, the instructor facilitated an opportunity for closing the information gap by helping learners assimilate new knowledge about TPACK with their existing knowledge structures (Khambari, 2019). This approach enabled learners to extend their conceptual knowledge about TPACK and apply the acquired knowledge in different contexts (Chan et al., 2018).

Impact of strategy used for extending learners' interest: *Assimilation of TPACK in different contexts*

As a response to the question by the instructor, learners provide correct examples of the components of TPACK from various contexts, thus exhibiting assimilation. The instance below shows learners' response in the PwD project context.

> *Instructor: So TPACK is a framework that identifies three types of knowledge, technology, pedagogy, and content. Give an example ..from the PwD context, Content Knowledge means knowledge of ___?*
>
> *S12: knowledge of how to identify PwD student*
>
> *Instructor: Okay.*

In another instance, when the instructor posed an example from another new context (VRLE) and asked learners to identify CK, PK, and TK. Almost 7-8 learners simultaneously gave the correct answers.

> *Instructor: Now what is the content piece (CK) in that (VRLE)?*
>
> *7-8 learners simultaneously: EMF*
>
> *Instructor: EMF, right Everybody got that okay, what is the technology Piece(TK)?*
>
> *7-8 learners simultaneously: VR*
>
> *Instructor: What is pedagogy (PK)?*
>
> *S7: The strategy he is using*
>
> *Instructor: .. got it..That's all.*

Learners assimilate when they integrate new knowledge with their old knowledge structures. Correct examples given by learners in both excerpts above show that they have assimilated the TPACK framework into their prior knowledge about requirements for developing training resources. In the above episode, the indicators of different

components of the interest cycle (i.e. trigger, immerse, and extend) are mapped to the evidence from the classroom activity.

Indicators of sustained interest throughout the course

This section is organized according to the phase-wise indicators from the interest loop, with analysis from the various data sources: interest survey (containing both Likert-scale followed by examples and open-ended questions), interviews, and reflection journal (described in detail in the Methods section).

Triggering interest

In the survey when asked "What triggered the interest for you when you heard of the ISD course before you joined it?". Learners responded as,

> *S11: ..the only motivation for taking this course was to contribute to the project as the project outcome had huge implications on someone's academic life.*
>
> *S2: ..Besides because this particular instructor was taking this course, ..I have heard a lot about his innovative way of teaching.*
>
> *S10: The teaching model.*

In the above responses it is visible that learners were curious about the PwD project for its social value (ex: S11) and teaching method of instructor (ex: S2 and S10).

The following Likert-scale item in the survey indicated responses that supported triggering of interest (See Table 2):

Table 2

Learners' responses on a five-point Likert scale for the one item.

Item	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
I find the class activities rewarding in terms of experience	11	6	0	0	0

For the follow-up open ended question in the survey, "Can you provide some examples to support your response to the previous (Likert-scale) item?", learners have responded as follows:

> *S4: Working on a live project was a new experience (interaction with SMEs, and stakeholders)*
>
> *S12: Almost all classes, activities are very interesting. Enjoying the activities.*
>
> *S11: Activities that require us to brainstorm different ideas or processes are the ones that are most rewarding to me. I particularly enjoy seeing how*

different abstract ideas come into concrete and useful existence.

Learners were eager to participate as they found the class activities rewarding and they had a desire to experience the teaching methodology used by the instructor. In an individual interview, when asked about "What specific factors positively or negatively influenced your interest at different stages of the course?". Learners have responded as follows:

S11: One thing is this project based type learning it's not there in the traditional lecturing.
S14: We were motivated because of the Project goal.. we had multiple levels of instruction as well as multiple levels of learning.
S12: There was like, we are doing something for the specially-abled person. So that also kept us motivated.

The above interview responses indicate that project based learning, type of instructions and social value of the PwD project were the factors which have a positive influence on learners' interest.

In the reflection journal, learners wrote their reflections asynchronously about their learning.

S13: The discussion during the class was interesting as we covered many different topics. Interesting were the "digressions" and how it can be productive. Also, the discussion on "systems" view was enlightening

Learners used this reflection activity as an opportunity to externalize their learning. Reflections were often about their 'aha' moments and led to their increased interest in the course activities.

Immersing interest

Two Likert-scale items in the survey indicated responses that supported immersion of interest (See Table 3):

Table 3

Learners' responses on a five-point Likert scale for the one item.

Item	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
I enjoy the activities of the class, being unaware of the passage of the time	8	5	4	0	0
I am getting a chance to communicate/ express my thoughts with others	15	2	0	0	0

In the above responses a majority of learners (13 out of 17 learners for the first item and all 17 for the second item) agreed for the fact that they enjoy the class activity and they get a chance to express their thoughts (See Table 3). It is seen that learners enjoy the class activities and are unaware that the passage of time in activity means they become actively engaged members in the activity and get into the state of flow. For the follow-up open-ended question: "Can you provide some examples to support your response in the previous items?", learners have responded as follows:

> *S17: I sometimes forget the time and go late..*
> *S4: The most frequently used phrase of the instructor "Does anyone want to attempt to answer this question?" This allows everyone to speak and it leads to a healthy discussion.*

In the individual interview, when asked about "What specific factors positively or negatively influenced your interest at different stages of the course?". Learners have responded as follows:

> *S13: The course was conversation driven and discussion oriented. So that was enough to hold the attention for longer duration, like three hours, and many of the times the class has to go beyond three hours... interaction with SME (subject matter experts)..created more empathy..interaction with PwDs..experience sharing was really moving for me personally..So that was the catalyst for me to sustain my interest positively.*
> *S11: I was working on the website, I kept on updating for many hours and working on it without thinking. I was enjoying, so I kept doing.. I knew that this was important..I wanted to somehow perfect whatever content we had.*
> *S14: Time duration of the course is like 3 hrs. And then in the initial days it would even stay on for longer. So we have ended meetings at 1:30 (i.e. 4.5 hrs in total)*
> *S17: When they (team members) didn't find it (resources) after spending four or five hours, they used to hold meetings in which.., we were not able to find an intro video. So then, I just took charge of creating the script for the introduction video.*

The above responses indicate that learners got into the state of flow because discussion oriented activities and interactions with the SME, as well as PwDs were main driving

forces which kept them engaged. Learners have spent a more than expected time after the class and on developing training resources and refining them by putting extra efforts.

In the reflection journal learners have reported:

> *S14: I enjoyed the workshop activity with my batch mates. The model seems to be quite comprehensive.. Activities designed were coherent to the flow of the workshop.*

This response shows that S14 was paying attention to the comprehensiveness and coherence of workshop activities and was in a state of flow while being engaged in a workshop.

Extending interest

The following Likert-scale item in the survey indicated responses that supported extending of interest (See Table 4):

Table 4

Learners' responses on a five-point Likert scale for the one item.

Item	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
I find the PwD project an interesting extension as an application of the learning that is happening in the course	13	3	1	0	0

For the follow-up open ended question, "Can you provide some examples to support your response in the previous items?", learners have responded as follows:

> *S1: Any extension into the real world would be interesting irrespective of the topic.*
> *S9: This is extension of our HCI course project, so we first year all are very excited to do something meaningful*
> *S11: I see the whole objective of the Pwd project through the ISD course is the application of the concepts.. The curation of the content on the website is very much aligned to the course content.*

The responses show that 16 out of 17 learners agreed that the PwD project was an interesting extension to apply ISD knowledge (See Table 4). Further they expressed that application of concepts into real-world settings is interesting and it was meaningful for their context, indicating that learners have extended their interest. In the individual

interview, when asked about *"You invested considerable time creating resources outside class hours. What kept you interested to continue this work? What challenges did you face and how did you overcome them?"*. Learners have responded as follows:

> *S13: Learning animation videos and learning how to write the script..she (team member) taught us how to systematically write every scene..Then some logistic issue came.. So all those things were small little challenges which we overcame.*
> *S14: Enjoyed creating the "check your understanding cartoons". That was the most enjoyable part of it, basically because I got to be creative in that.*
> *S12: I enjoyed the storyline, we created that whole scenario. So we enjoyed it, because we struggled a lot.*

Learners expressed that they enjoyed working out of the class (synchronously and asynchronously). To create training resources, learners were expected to learn new skills for content creation/curation. They faced challenges but found it as a meaningful extension of ISD knowledge.

In the reflection journal, a learner has reflected as:

> *S8: Teaching through examples and asking students to give more examples helps me to connect to concepts more.*

Discussion

This study investigated the implementation of IDC theory in a graduate level semester-long PBL course, and how the instructional strategies helped sustain the learners' interest. The findings indicate that the instructional strategies applied by the instructor were able to trigger, immerse, and extend the learners' interest in the course. Sustained interest in the course was shown by mapping learner responses to the indicators provided by IDC theory for interest loop. Our findings consistent with Wong et al. (2023), suggest that initial class discussion on the course contents and the semester-long project facilitated by the instructor piqued learners' curiosity to learn new topics they were unaware of. The core approach of the course, that is, project-based learning situated in an authentic context, provided an opportunity for learners to apply ISD skills and knowledge into real-world settings, and resulted in a public artifact, the website to sensitize members of our institute community to the needs of PwD. This learning experience had a positive impact on learners' interest. The social value of a PwD website project led to learners' sustained

interest throughout the course, aligned with similar research findings (Halliday, 2002). We observed that despite the ill-structured and cognitively complex nature of the project, learners sustained their interest throughout the course due to the high social value of the PwD project. Additionally, to sustain learners' interest throughout the course, instructors factored in the real-world relevance of the PwD project while making design decisions for the semester-long project. Interview responses show that participants were interested in the semester-long project due to the perceived social value of the project and their ability to envision its real-world impact. The interview responses presented in Section 5.2.1 indicates that though learners (with average age 32 years) might have stronger goal orientation and intrinsic motivation toward learning, the PwD activities aligned to IDC theory (interest loop) played a crucial role in sustaining learners' interest throughout the semester-long course.

Our study has been able to identify specific collaborative and discussion driven course activities that support interest. The conceptual richness and complexity of the TPACK framework demands deeper cognitive engagement of learners which was achieved through careful orchestration of IDC - interest loop. The strategy of concept formation, where learners were not provided with the formal concept initially and encouraged to formulate their own labels for the categories based on the given examples, triggered their interest (Wong et al., 2020a). The inductive presentation of a blank table (Figure 2) created a knowledge gap that "triggered" learners' curiosity and the active learning strategy of "each one say one" further pushed learners' involvement and their desire to know more about TPACK. The voluntary turn taking in EOSO activity and multiple rounds of feedback provided by the instructor led to learners' immersion in understanding different knowledge components of the TPACK framework. Instructors further provided opportunity for learners to apply recently acquired knowledge (of the TPACK framework) to another context familiar to them. Instructor dwelled on the wide applicability of TPACK framework and asked learners to map the required knowledge component to VRLE project, which provided learners with a familiar and relevant platform for "extending" interest. Learners were voluntarily engaged in the activity for more than expected time and reported enjoying the task at hand. In another application, the instructor also provided an immediate opportunity to apply the ISD concepts to create resources for the PwD website. Our findings showed that learners were in a state of flow as they spent more than expected time in creating the PwD website resources and group presentations. Research by Halamish et al. (2019) shows that curiosity-driven learners tend to invest more time in learning, even beyond expectations. Learners assimilated conceptual understanding of ISD and extended their knowledge in meaningful and relevant ways while working towards the concrete and realistic project. This was found to be a driver for extending their interest, as reported by Wong et al (2023).

This study also provides a nuanced and detailed understanding of the functioning of the interest loop. The IDC theory (Chan et al., 2018) describes the nature of operationalization of the interest loop for an individual learner. Our findings extend this application to a collaborative classroom. For the trigger component of interest, our findings show that in a collaborative classroom activity, the trigger for each learner can be at different points of time. In addition, some learners get triggered by other learners' responses i.e. the triggers may be decentralized. In the collaborative activity, the state of flow for different learners can vary depending on their level of engagement during the immense phase. Our findings indicate that the nature of participation of various learners differs substantially. There may be multiple factors at play which influence the learners' engagement in the immerse phase, and these need to be further investigated. For collaborative activities in the classroom, the execution of an active learning method (such as each-one-say-one) has the potential to immerse learners' interest in its design if the learners are aware about the active learning method and one's own role in it.

Further, to sustain learners' interest throughout the course, instructors factored in the real-world relevance of the PwD project while making design decisions for the semester-long project. Evidence shows that participants were interested in the semester-long project due to the perceived social value of the project and their ability to envision its real-world impact. Though learners might have stronger goal orientation and intrinsic motivation toward learning, the PwD activities aligned to IDC theory (interest loop) played a crucial role in sustaining learners' interest throughout the semester-long course.

Some of the context-specific guidelines are as follows: a) to trigger learners' interest during semester-long project-based courses, instructors can employ authentic, real-world, and socially relevant problems. b) To immerse learners into learning activities, instructors can design synchronous inductive activities to acquire knowledge, synchronous hands-on activities to deeply engage learners, and asynchronous reflection activities to refine the collective knowledge. c) To extend learners' interest, instructors can provide immediate and continuous opportunities to apply acquired knowledge.

Limitations and future work

The first limitation is the small number of participants in the course (N=17). Since this study reports longitudinal data from multiple sources, learners' responses could be analyzed at different levels of granularity, which enabled us to show detailed manifestation of their interest at activity and course levels. As the sample size is small, some of the findings might arise from responses from the same set of students. Future studies could consider increasing the number of participants, which could strengthen the robustness of the findings, for example, a larger number of students might provide similar responses for the indicators of interest. In addition, additional indicators also may be

identified with a larger participant group. All the classroom activities were collaborative in nature, which might have impacted learners' interest. The second limitation is in terms of the theoretical lens. The visible evidence of interest was mapped with the indicators given in IDC theory without explicitly considering the lens of collaborative learning. Future research could consider the aspect of collaboration when investigating interest in the classroom. Potential research goals could examine: a) the role of collaboration in triggering learners' interest, b) differentiated state of flow within a collaborative activity, c) varied extent of impact on extending the interest for different learners, d) the dynamics within the small groups and its impact on individual and collective interest. The third limitation is that we did not account for learners' initial intrinsic motivation or the types of problems presented in the ISD course, both of which may have influenced how their interest was sustained. Although participants explicitly attributed their sustained interest to specific course design features, the absence of a control group or baseline motivation assessment limits our ability to conclusively isolate IDC theory's effects from learners' preexisting motivation levels. Future research could address this by including such measures to more rigorously distinguish the effects of IDC-aligned instructional strategies from baseline motivation. Additionally, future research could examine how individual motivation and the nature of problems in project-based learning courses interact to shape learners' interest over time. Learners' educational and cultural contexts may have influenced their experiences; however, only the structural context of the course was considered in this study. Future research could investigate how educational and cultural factors shape learners' interest. Another possible future study can include evaluating students' long-term interest after the end of the course.

Conclusion

The objective of this study was to provide empirical evidence for the interest loop of IDC theory in a semester-long course. Learners' interest holds supreme value in a semester-long course, and sustaining it throughout the course is a challenging task for instructors. This paper adds to the body of research that examines the application of IDC theory and provides empirical evidence of sustained interest at an activity level as well as an overall course level. The deliberate application of the interest loop of IDC theory for triggering, immersing, and extending learners' interest has been crucial in sustaining it throughout the course. Facilitating a socially impactful project, such as the PwD website, proved to be a promising instructional strategy that sparked initial interest and sustained it throughout the course. At the activity level, the example-first approach piqued learners' curiosity. An ill-structured problem in a collaborative setup enabled them to refine their learning, apply their knowledge in different contexts, and remain engaged. This study

particularly focused on the context of collaborative classroom activities in a PBL course, and shows how the instructional strategies can support the triggering, immersing and extending interest in collaborative classroom activities. Further research can include an extension of IDC theory within a collaborative learning context.

Appendix 1

Mapping of interview and survey questions with the components of interest cycle:

Table 1a

Detailed mapping of interview and survey questions with the components of interest cycle.

Sr. No.	Particular	Mapping with components of interest
Interview protocol Purpose: To examine learner interest development as per interest loop of IDC theory following completion of Instructional System Design (ISD) course. Interview Structure Duration: 20-25 minutes Format: Semi-structured interview Recording: Audio recorded with participant consent		
1	Objective: To know about Learning approach comparison Q: What are the key differences between learning through traditional lectures and learning in the ISD approach, where real-world problems guide problem-solving? Probe if needed: Where were you first made aware of real-world problems that sparked your interest in problem-solving?	Triggering
2	Objective: To know about interest trajectory throughout the course Q: Can you describe your interest level at three key points in the ISD course? Start: Initial interest when the PwD website project was introduced Mid: Interest during module presentation to Ummeed stakeholders, ISD experts, and PwDs End: Interest when conducting user studies and gathering feedback	Immersing
3	Objective: To know about Interest Influencing Factors Q: What specific factors positively or negatively influenced your interest at different stages of the course?	Immersing
4	Objective: To know about Feedback Integration Process Q: How did you experience the learning process when incorporating feedback from subject matter experts and PwD stakeholders while creating your training resources? Probe if needed: Can you tell specific challenges while incorporating feedback and strategies applied to overcome those with examples?	Immersing
5	Objective: To know about Out-of-Class Engagement Q: You invested considerable time creating resources outside class hours. What kept you interested to continue this work? What challenges did you face and how did you overcome them?	Extending
6	Objective: To know Initial Course Expectations Q: When the course goals and objectives were first presented, what were your initial thoughts?	Immersing
7	Objective: To know about Most Engaging Activities Q: Which specific activities—both in-class and out-of-class, engaged	Immersing

	your interest most? Can you describe particular instances that sparked your curiosity? Closing by Asking if participant has additional thoughts to share	
Survey questions		
1	(Type: Open ended) Q: What triggered your initial interest in the ISD course before you joined it?	Triggering
2	(Type: Open ended) Q: I look forward to attend every ISD class because _____	Triggering
3	(Type: Likert scale) Q: I enjoy the activities of the class, being unaware of the passage of the time	Immersing
4	(Type: Likert scale with follow-up example) Q: I find the class activities rewarding in terms of experience? Can you provide some examples to support your response in the previous question?	Triggering
5	(Type: Likert scale with follow-up example) Q: I find the Pwd project an interesting extension as an application of the learning that is happening in the course? Can you provide some examples to support your response in the previous question?	Extending

Abbreviations

ADHD: Attention Deficit Hyperactivity Disorder, CK: Content Knowledge, CPS: Collaborative Problem Solving, IDC: Interest-Driven Creator, ISD: Instructional Systems Design, LD: Learning Disabilities, LOs: Learning Objectives, PBL: Project-Based Learning, PCK: Pedagogical Content Knowledge, PK: Pedagogical Knowledge, PwD: Persons with Disabilities, SD: Standard Deviation, SME: Subject Matter Expert, TA: Teaching Assistant, TELEs: Technology-Enhanced Learning Environments, TK: Technological Knowledge, TPACK: Technological Pedagogical Content Knowledge, TCK: Technological Content Knowledge, TPK: Technological Pedagogical Knowledge, TPS: Think-Pair-Share, VRLE: Virtual Reality Learning Environment.

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Author's contributions

All authors contributed to the study's design, data analysis, and manuscript preparation, and have approved the authorship order as it appears in the byline.

Author's information

Vishwas Badhe is a Ph.D. student in in Centre for Educational Technology at the Indian Institute of Technology (IIT) Bombay, India. His research includes learning and regulation processes from the lens of theories such as socially shared metacognitive (SSMR) regulation, transactivity, interest driven creator (IDC) theory in ill-structured collaborative problem solving (CPS) for undergraduate and graduates learners. He holds bachelors and master's degree in computer engineering from Savitribai Phule Pune University, Pune, India and worked as assistant professor in the same domain.

Sunita Raste (Ph.D.) is an EdTech researcher at the Centre for Educational Technology, Indian Institute of Technology (IIT) Bombay. Her research focuses on supporting undergraduate learners' sensemaking in technology-enhanced learning environments (TELEs), with an emphasis on cognitive-affective processes and interest-driven creation. She was awarded the Prime Minister's Research Fellowship for her work on pedagogical implementations of TELEs to support scientific sensemaking. She holds a master's degree in Biotechnology from the University of Mumbai and has previously worked as an assistant professor in the same field.

Sahana Murthy is Professor in Centre for Educational Technology at the Indian Institute of Technology (IIT) Bombay, India. Her research interests include developing learners' pan-domain cognitive skills using technology enhanced learning environments. She has worked in the areas of the integration of ICT by college instructors and physics education research. She received her Bachelor's degree from the University of Mumbai, India, Master's degree in physics from IIT Bombay, and PhD in physics from Rutgers University.

Sridhar Iyer is Professor in Centre for Educational Technology at the Indian Institute of Technology (IIT) Bombay, India. His research focuses on technology-enhanced learning, teacher use of educational technologies, and computer science education research. He has been a faculty member at IIT Bombay since 1999 and has previously worked in the

Department of Computer Science and Engineering. He received his B.Tech., M.Tech., and Ph.D. in Computer Science and Engineering from IIT Bombay.

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Author details
[1] Centre for Educational Technology, Indian Institute of Technology Bombay, Powai, Mumbai, India

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